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ABSTRACT

A multi-faceted study followed up 800 children originally administered SCREEN, a comprehensive early identification screening battery. Ss were given an individually administered diagnostic battery: The Illinois Test of Psycholinguistic Abilities (ITPA), The Wechsler Intelligence Scale for Children (WISC) Verbal Scale, The Beery Visual Motor Integration Test (VMI), and an Experimental Phonetics Test. Factor Analysis on the SCREEN battery and on the ITPA within the "high risk" sample yielded more complex factor structures which provided substantial construct validity for both tests. Evidence suggested that the SCREEN battery is an adequate to substantial predictor of achievement tests. Concurrent and predictive validity studies indicated that the ITPA and PIAT (Peabody Individual Achievement test) were better predictors of school achievement than were the WISC scale and the VMI. Separate cluster analysis of the SCREEN battery and ITPA revealed homogeneous subclusters of Ss who displayed specific patterns of deficits. Results demonstrated that there is a reliable and valid technology for identifying relatively homogeneous groups of learning problem children. (Author/CL)

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APPLICATION OF CLUSTER ANALYSIS TO IDENTIFY MORE HOMOGENEOUS GROUPS OF CHILDREN WITH LEARNING PROBLEMS

by

Anthony Harlan Luick

A Dissertation Submitted to the Faculty of the

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STATEMENT BY AUTHOR

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ABSTRACT

In May and June of 1974 the comprehensive early identification screening battery, SCREEN, was administered to approximately 3,500 children in kindergarten and first grade. This is a multi-faceted study which followed up 800 of these children with an individually administered diagnostic battery; the Illinois Test of Psycholinguistic Abilities, the WISC-Verbal Scale, the Beery VMI, the Peabody Individual Achievement Test, and an Experimental Phonetics Test. Two-thirds of this sample were considered "high risk" based upon the SCREEN test results and/or teacher referrals. In addition, a 2½ year follow-up was conducted on a substantial portion of this population with both group administered achievement tests and teacher ratings of academic achievement.

Factor analysis on the SCREEN battery and on the ITPA within the various "high risk" samples as compared to the control sample yielded more complex factor structures which provided substantial construct validity for both tests. In addition, the concurrent and predictive validity studies of the SCREEN test compares favorably with that of both individually administered diagnostic tests and other group readiness and achievement measures. The predictive validity of the SCREEN battery with the group administered achievement procedures over a 2½ year period was not substantially different from its concurrent validity coefficients. The evidence from this study in conjunction with previous concurrent validity studies indicates that the SCREEN battery is an adequate to

substantial predictor of group administered and individually administered achievement tests.

The concurrent and predictive validity studies with the ITPA demonstrated an adequate degree of relationship with measures of school achievement and a substantial relationship with the WISC-Verbal battery. The concurrent and predictive validity of the other individually administered measures with group administered achievement tests demonstrated that the PIAT given in kindergarten and first grade was a substantial predictor of school achievement in third and fourth grade, while the WISC scale and the VMI were found to be relatively poor predictors of school achievement.

When both the SCREEN battery and the ITPA were cluster-analyzed separately, homogeneous subclusters of children who displayed specific patterns of deficits were identified. Various "high risk" profiles based on the SCREEN child skill tests have close to a 100% probability of predicting significant below average performance on a variety of educational diagnostic instruments. However, it was demonstrated that there is little efficacy in relying solely on teacher ratings as a referral system for "high risk" children in the schools. Teachers were found to make serious over- and under-estimates of children's educational capabilities. Teacher ratings have their best utility in predicting educational deficits only when used in combination with other objective child skill tests.

Cluster analytic results on the ITPA subscales demonstrated that there are relatively homogeneous performance patterns which significantly predict above and below average performance on other diagnostic tests, thereby providing a substantial empirical foundation for its differential diagnostic utility. Perhaps, the most important result of the present series of studies was to demonstrate that there is a reliable and valid technology for identifying relatively homogeneous groups of learning problem children.

CHAPTER I

INTRODUCTION

There is considerable diversity in defining and subsequently identifying the various characteristics which describe the child who exhibits learning problems. An integrative research approach utilizing evidence from various disciplines including medical, educational, and psychological research will be necessary if characteristics are to be isolated which will have predictive potential in identifying school failure in areas of reading, writing, spelling, and arithmetic.

There are multiple and overlapping terminologies which are used to describe children who exhibit deficiencies in basic school skills, there being as many as forty terms in the literature to denote some aspect of the general problem. Clements (1966) states that terms such as "dyslexia," "minimal brain dysfunction," and "learning disabilities" are often applied to children with very similar conditions. Such terminology has distinctive theoretical underpinnings which are variously supported by different professionals.

Wiederholt (1974) notes that the field's history has roots in "medical-neuropsychological" and "psychoeducational" orientations. The medical-neuropsychological approach places an emphasis on the relationships of the brain and physical dysfunction as antecedants to learning problems (Kephart, 1963; Orton, 1937; Strauss & Lehtinen, 1947). The

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psychoeducational approach is more recent and represents a reaction against the medical approach with the stress on more educationally relevant psychological descriptions of the disabled child's functioning. This more recent trend focuses on identifying educationally meaningful strengths and weaknesses of the child which can be mediated through individual prescriptions.

As a result of the various medical, psychological, educational, and legislative categorization schemes, definitions of learning problems have become very general and relatively non-operational (Education for All Handicapped Children's Act, Public Law 94-142, 1975). The major disadvantage of these definitions has been a perpetuation of many identification/diagnostic procedures which undermine the orderly accumulation of knowledge about problems subsumed in the broad categories. These broad classifications may have administrative utility but they do not represent useful schema for psychoeducational research concerned with underlying processes involved in learning. The term "learning disabilities," for example, includes a heterogeneous group of disabilities and has not been useful in developing non-controversial remedial programs nor in understanding the psychological dysfunction(s) which may be involved.

Identification and diagnostic procedures are typically developed and in use before adequate reliability and validity has been demonstrated on appropriate target samples. The economics and logistics of identifying appropriate target samples in the broad school population are generally prohibitive, contributing to the accumulation of "convenience" sample studies which have little generalizability and even less relationship to an educationally relevant classification system. Senf (1974) has outlined a classification plan that involves three major phases: (1) identifying the target children, (2) identifying the types of disabilities contained in this target population, and (3) validating the specific types of disabilities found by establishing empirical correlates of these types useful in the schools. Such a plan contributes to meaningful psychoeducational research into the correlates of school failure and the subsequent validation of a classification system for both early identification and subsequent diagnosis of learning problems.

Background to the Study

In May and June 1974 a comprehensive early identification screening test (Senf & Comrey, 1975) was administered to approximately 3,500 children in kindergarten and first grade throughout six districts in the Chicago metropolitan area. The test, SCREEN, was designed for group administration in the early primary grades.[1] It assesses Self Concept and School Adjustment, Visual Skills, Auditory Skills, Figure Copying, Basic Knowledge, and General Readiness (comprised of the preceding four skill areas). Teacher ratings of the child's behavior assess four factorally derived areas termed Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment, and Immaturity (Senf & Comrey,

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[1] SCREEN was authored by Gerald M. Senf and Andrew L. Comrey with the assistance of Anthony H. Luick and Michael S. Pallak.

1975). The SCREEN early school assessment battery has been demonstrated to have acceptably high reliability and unusually high concurrent validity in studies which included approximately 10,000 children in grades K-3 (cf., Summary of SCREEN Reliability and Validity Data, 1975, Appendix A). Concurrent with the 1974 SCREEN assessment, the children were administered group achievement tests. During the summer of 1974, approximately 800 children were followed-up with an individually administered diagnostic battery. Two-thirds of this sample were to be considered "high risk" based upon the SCREEN test results and/or teacher referrals, while the remaining third of the sample constituted a control group, selected randomly from the remaining children who were neither teacher nor SCREEN referred. The follow-up diagnostic data, as well as the initial screening and group achievement data (the Metropolitan Readiness Test for kindergarten and the Metropolitan Achievement Test for first grade), will be examined in determining the concurrent validity of both the screening procedure and the diagnostic measures. The diagnostic battery included the entire Illinois Test of Psycholinguistic Abilities (ITPA), the Wechsler Intelligence Scale for Children-Verbal Scale (WISC), the Beery Visual-Motor Integration Test (VMI), the Peabody Individual Achievement Test (PIAT), and an Experimental Phonetics Test developed by the present writer. Generally, such a comprehensive diagnostic follow-up battery on such a large number of "high risk" subjects has not been available for validity, cluster, or factor analytic studies.

To place these data in perspective, it is noteworthy that both the ITPA and PIAT standardization samples consisted of approximately

100 kindergarten and first grade children. The present "control" sample is as large as this while the "high risk" sample is nearly three times larger in each grade. Such large size samples are necessary in order to permit stability of measurement in utilizing factor analytic procedures (Comrey, 1973) and for conducting cluster analyses (Senf & Luick, 1976). More importantly, the existence of disabilities which occur with low frequency can only be discovered through examination of large samples.

In addition to the concurrent diagnostic and achievement data, a recent $2\frac{1}{2}$ year follow-up with group administered achievement tests and teacher ratings of school skills was completed. The SRA Assessment Survey and the Cooperative Primary Test were administered to the original kindergarten children while they were in the third grade. The Iowa Test of Educational Development, the Stanford Achievement Test, and the Cooperative Primary Test were administered to the original first grade children while they were in the fourth grade. The screening and diagnostic data will be examined in relation to their predictive validity with the follow-up achievement test and teacher ratings.

Focus of the Study

This is a multifaceted study designed to focus on five central research issues:

1. to compare factor analysis results obtained on a "high risk" sample to those obtained in using a control sample which represented the total range of children attending public schools;

2. to examine the concurrent validity of the SCREEN test and the ITPA in relation to group achievement and other diagnostic measures;
3. to examine the predictive validity of the SCREEN test and the ITPA in relation to group administered achievement tests and teacher ratings of school skills;
4. to investigate the utility of cluster techniques in identifying more homogeneous subclusters of children who display specific patterns of performance on the group administered early identification SCREEN test and on the individually administered ITPA;
5. to determine the relationship between specific homogeneous performance patterns derived from the cluster analyses on the SCREEN test and the ITPA with the Wechsler Intelligence Scale for Children, the Peabody Individual Achievement Test, and the individually administered Experimental Phonetics Test.

Perspective on the SCREEN Early Identification Procedure

SCREEN is a battery of classroom administered child tests and teacher ratings of the child's school related characteristics. SCREEN was designed to forecast school adjustment and success in the early grades and to offer, through computerized feedback reports, a detailed description of each child's school relevant abilities (Senf & Comrey, 1975). SCREEN is a comprehensive child test and teacher assessment battery designed to identify school adjustment and skill problems in the early grades (primarily kindergarten and first grade). The battery was graphically designed for classroom administration by the regular classroom teacher without necessitating specific training. A further description of the content in each of the areas assessed and the item format can be found in Appendix A.

For an early identification screening battery in grades K and 1, the SCREEN procedure demonstrates an unusually adequate reliability across the subscores. The split-half reliabilities of the ten SCREEN scores in grades K and 1 range from .75 through .96 in the norm sample of approximately 10,000 children (cf., Summary of SCREEN Reliability and Validity Data, Appendix A).

In the norm sample (grades K-3), 29 different achievement tests containing 191 variables were used as concurrent criteria for prediction by the nine SCREEN scores (omitting General Readiness because it represents a summation of all the other child skill scores). The average multiple correlation for SCREEN with the 191 subtest variables was .73 and .84 for the 19 tests which provided a total score for use as a criterion measure (cf., Summary of SCREEN Reliability and Validity Data, Appendix A). Generally, group screening procedures developed for the assessment of early school skills in grades K and 1 have not been able to demonstrate such unusually high reliability and validity coefficients. Such reliability and validity is necessary if one is to utilize the data for identifying children in the early school grades who are most in need of individual diagnostic attention.

Prior Factor Analysis of the SCREEN Test

Previous factor analysis of the SCREEN battery yields primarily two strong factors (Comrey, Senf, & Luick, unpublished paper 1975). A pronounced general readiness factor running through all intellectually oriented tasks in the early grades was found to be identical for both males and females. Factor II consisted of all teacher ratings. It is interesting to note, however, that teacher ratings of Cognitive-Perceptual skills loaded very highly on the general readiness factor. Interpretation of the factor study was that teachers assessed general readiness in their students about as well as one of the other SCREEN skill ability subtests but not nearly well enough to rely on their judgment alone about which students need special attention. Social skills, immaturity, cooperativeness, and gender identity had a marked effect on teachers' evaluation of pupil intellectual ability and aptitude. It was also noted that the child's frequency of negative feelings about himself (Self Concept and School Adjustment) is not substantially related to the teacher rating factor. These findings suggested that teachers need additional help of professional psychological testing to identify all those children who would benefit from special education in the early grades. It was concluded that the common reliance on a teacher referral system alone tends to permit too many unnecessary referrals and fails to refer children in need of individualized attention.

One should note that the factor analyses tend to yield simplified interpretations of data. The simplicity of the general readiness factor in SCREEN occurs with a large representative sample of school children (10,000 children within four grades). There is a very wide range of ability in this group and only a relatively small percentage of the subjects have severe learning problems. The sample which consists of individuals with assorted learning difficulties could be expected to produce a much more complex factor structure, perhaps shedding light on the problem of how to classify individuals which fall in these categories (Comrey, Senf, & Luick, unpublished paper 1975).

Concurrent and Predictive Validity of the ITPA

Sedlak and Weener (1973) reviewed research on the Illinois Test of Psycholinguistic Abilities. The following discussion constitutes a brief review of their findings. One of the early studies (McCarthy & Olsen, 1964), utilizing a sample of 86 subjects and an age range from 7 to 9 years, found concurrent validity coefficients ranging from .03 to .65, with a median of .15 with the Stanford Achievement Test and the Durrell-Sullivan Reading Test. The predictive validity coefficients (over a three-month period) range from -.19 to .53, with a median of .23. Sedlak and Weener (1973) note that lower coefficients may have been produced by the experimental ITPA because the sample had a substantial number of subjects at the upper end of the age range. Subsequent studies have yielded higher coefficients using younger subjects in their samples.

Mueller (1965, 1969) reported concurrent validity results on 101 subjects and subsequent predictive validity results with educable mentally retarded children. The total ITPA score or PLQ yielded moderate concurrent validity coefficients ranging from .26 to .67 across 10 criterion measures. Sedlak and Weener (1973) report that the Arithmetic subtest of the Wide Range Achievement Test (WRAT) produced the highest coefficient (r = .67) and the Mathematics subtest of the New York Achievement Test (NYAT) produced the next highest coefficient (r = .61). The lowest coefficient in Mueller's studies (r = .26) was for the Reading subtest of the WRAT. The composite score of six achievement subtests used as a criterion yielded a correlation of .65 with the ITPA PLQ score.

In the Mueller (1965) study the Auditory-Vocal Association subtest of the experimental edition of the ITPA yielded the highest coefficient for every one of the ten criteria tests which were utilized. Furthermore, the Auditory-Vocal Association subtest alone predicted the composite achievement score as well as the total ITPA score. This was interpreted as indicating that there was a strong general factor underlying all the criterion measures, which was accounted for by the variance in the Auditory-Vocal Association subtest.

In a two-year predictive validity study, Mueller (1969) administered the criterion measures to 89 out of the original 101 subjects. The raw scores on the experimental ITPA produced coefficients ranging from .17 to .67, these being comparable to those obtained two years earlier in the concurrent validity study. The two arithmetic subtests reported above produced the highest validity coefficients, r = .67 for the Math subtest of the NYAT and r = .51 for the Math subtest of the WRAT. However, the Reading subtests on the WRAT and the NYAT produced coefficients ranging from .17 to .26, respectively. The ITPA total score produced a coefficient with the composite of the achievement subtests of .53. One should note that these correlations are relatively high given the range restrictions in Mueller's educable mentally retarded sample.

Circirelli, Granger, Schemmel, Cooper, and Holthouse (1970) conducted a study evaluating the impact of the Head Start Program. For those children who participated in the summer-only Head Start Program, the revised ITPA subtests were correlated with the Metropolitan Readiness Test (MRT) at grade one, and between the ITPA subtests and the Stanford Achievement Test (SAT) at grades two and three. For the summer-only sample the ITPA Auditory Reception and Auditory Association subtests correlated most highly with the MRT subtest scores. The Grammatic Closure subtest of the ITPA produced a slightly lower correlation. Similar to the Mueller (1969) study, the Auditory Association subtest of the ITPA correlated with the MRT total readiness score as high as the total ITPA score (r = .61). This same Grammatic Closure, Auditory Association, Auditory Reception correlation result was obtained on the Stanford Achievement subtests.

Sedlak and Weener (1973) also record that the pattern of results for the full year Head Start children (Westinghouse Learning Corporation, 1969) were very similar. The revised ITPA subtests of Auditory Reception, Auditory Association, and Grammatic Closure yielded the highest correlation coefficients with the MRT total score in the first grade. By the end of the second grade, the Auditory Association subtest yielded the highest correlation on five of the six subtests and with the total MRT battery score (r = .54) while the total ITPA score correlated with the total SAT (r = .55). In the third grade, the Grammatic Closure subtest correlated more highly with the eight SAT subtests in comparison to any of the other ITPA subtests. Correlations ranged from .52 on the SAT

Word Recognition subscale to .34 on the Language subscale. Once again, the Grammatic Closure subtest correlated more highly with the SAT total subscore than did the total ITPA score (r = .56 and .48 respectively).

Warden (1967) conducted a seven month follow-up study with 67 middle class first grade children ranging from 6 to 7 years old. The predictive validity coefficients for the six subtests of the California Achievement Test (CAT) ranged from .44 for the Reading Comprehension subtest to .66 for the Reading Vocabulary subtest with the ten main subscales of the ITPA. The total CAT correlated .66 with the experimental edition ITPA total score. Once again, the ITPA Auditory Association subtest yielded the highest correlation for four of six subtests and the second highest predictive coefficient for the other two subtests of the California Achievement Test.

Hirshoren (1967) conducted a predictive validity study utilizing 40 Caucasians and 26 Blacks in a two year follow-up study using the California Achievement Test as the criterion. The validity coefficients ranged from .43 for Reading Comprehension to .75 for Arithmetic Fundamentals. The California Achievement Test total score correlated .72 with the ITPA total. However, the pattern of correlations obtained in the previous studies reported above were not replicated. The ITPA Visual-Motor Sequencing subtest produced the highest predictive coefficient for five of the six CAT subtests, while the ITPA Motor Encoding subtest produced the highest correlation coefficient with the CAT Arithmetic Fundamentals subtest. These inconsistent results in the correlation pattern may be the result of the fact that the experimental ITPA edition utilized in the Hirshoren (1967) study was normed and developed on Caucasian children. The correlation coefficients with achievement in the Black population were substantially lower than those obtained in the Caucasian group, with only the Arithmetic Achievement subtest producing statistically significant predictive coefficients.

Hirshoren (1967) and Mueller (1965, 1969) also compared the ITPA with measures of general intelligence. Mueller utilized the Primary Mental Abilities Test, the Pictoral Test of Intelligence, the Stanford-Binet, the Peabody Picture Vocabulary Test and the Coloured Progressive Matrices reporting that the correlation coefficients for a composite achievement score were .65, .56, .52, .30, and .11, respectively for the above tests. In comparison, the ITPA total score correlated .53 with the composite achievement score. The Hirshoren (1967) study utilized the Stanford-Binet and found a correlation of .60 with the total achievement score of the CAT, in comparison to a correlation of .72 for the ITPA. In both the Hirshoren (1967) and Mueller (1965, 1969) studies, the correlations between the intelligence scales and the achievement measures versus those between the ITPA and the achievement measures were not statistically different.

Rosenfield (1970) conducted a five month follow-up study with 30 first graders in predicting diagnostic reading scales. In addition, the Kent Series of Emergencies Scales, a test of mental ability, was used to predict the reading behavior over a five month period. The resulting correlations between the Kent Series and reading achievement and the revised ITPA and reading achievement were not statistically different.

In summary, the Mueller (1965, 1969), Hirshoren (1967) and Westinghouse Learning Corporation (1969) studies produced generally consistent results (cf., Sedlak & Weener, 1973, p. 122). In all four studies, reading, language, and the spelling achievement subtests produced lower correlation coefficients than did the arithmetic and science subtests. These studies also indicate that the ITPA total score correlated with the various achievement subtests produced substantial coefficients accounting for approximately 27-52% of the variance with the composite academic achievement scores. The lower validity coefficients in the Mueller (1965, 1969) and Westinghouse Learning Corporation (1969) studies are in all probability a result of the population characteristics of the samples studied. However, Sedlak and Weener (1973) interpret the results of these studies as indicating that the ITPA is less predictive of achievement for low ability groups than normal ability groups.

This conclusion would seem to be premature given that only one study correlating the ITPA with an achievement measure was of sufficient sample size for statistical stability and was conducted over a period greater than seven months between test and criterion. This was the Mueller (1969) study with range restrictions associated with the nature of the sample. Although the ITPA has become, perhaps, the most widely used psychoeducational diagnostic test, besides intelligence tests, no adequate assessment of its ability to predict achievement has been conducted. Previous studies have utilized atypical populations of insufficient sample size and have not allowed a sufficient period of time between test and criterion.

Previous Factor Analysis of the ITPA

Factor analysis studies on the ITPA have utilized extremely heterogeneous samples and there is no reason to assume the results of these studies are appropriate for exceptional children (cf., Luick, Agronowitz, & Busby, unpublished paper 1977). Sedlak and Weener (1973) report that the tentative factors which have been identified in factor analytic studies of the ITPA offer little support for a channel level process model on which the ITPA is based. However, it is not clear exactly what factor structure should result for the ITPA as one mirroring channel functioning would necessarily conflict with the process level distinctions and vice versa. Sedlak and Weener (1973) reported that one of the most common shortcomings of the factor studies on the ITPA was insufficient sample size to insure stable factors. Nunnally (1967) recommends that no more than "one-third as many factors as variables be employed (in the rotation phase of the analyses) because seldom would more factors either have substantial loadings or be of scientific interest" (cf., Mann & Sabatino, 1973, p. 123). In addition, factor analysis should have ten times as many subjects as factors (Nunnally, 1967). Failure to adhere to these basic criteria, in addition to numerous other research inconsistencies, has produced volumes of questionable factor analytic studies which have neither proved nor disproved construct validity of the ITPA.

Luick, Agronowitz, and Busby (unpublished paper 1977) conducted factor analyses on a sample of 93 female and 144 male Caucasian subjects diagnosed as "aphasic" drawn from predominantly middle class areas in

Southern California. These children were selected from approximately 40 districts and approximately 80 different aphasic classes. All the children were of at least average intelligence on the WISC Performance Scale and were assessed as having normal hearing. Subjects ranged in age from 72 to 99 months, corresponding to seven age groups in the ITPA norm study (Kirk, McCarthy, & Kirk, 1968). Utilizing scaled scores, two major factors were extracted with Factor I accounting for 80.6% of the variance and Factor II accounting for 19.4% of the variance for the varimax rotated factor matrix after rotation with Kaiser normalization. The major loadings (above .30) associated with Factor I were: Auditory Reception (.64), Auditory Association (.81), Verbal Expression (.56), Grammatic Closure (.67), and Auditory Sequential Memory (.33). Factor II major loadings were: Visual Reception (.57), Visual Association (.67), Manual Expression (.52), Visual Closure (.54), and Visual Sequential Memory (.38). The results indicate that two major factors were found which were very large and very consistent. Factor I was described as representing an auditory-vocal channel of communication, providing support for the ITPA psycholinguistic theory of channel processes (cf., Paraskevopoulos & Kirk, 1969, p. 12). Factor II can be described as representing a visual-motor channel of communication, again providing evidence for the channel process conceptualization.

Such regularity in the ITPA subtests intercorrelations sheds light on the theoretical assumptions underlying the psycholinguistic model. Paraskevopoulos and Kirk (1969) noted that since there was such a high correlation in the norm sample between Auditory Association and Grammatic

Closure subtests (r = .60), theory regarding intralevel and intrachannel relationships were open to reconsideration, especially since data descriptive of average populations may not be very relevant to populations of exceptional children. This study on aphasic children found that Grammatic Closure correlates significantly with Auditory Reception (r = .43), Auditory Association (r = .59), and Verbal Expression (r = .46) with all the subtests loading on Factor I, providing empirical support for Grammatic Closure having a representational level of commonality and a strong Auditory Association, auditory channel relationship. Similar to the Luick, Agronowitz, and Busby (unpublished paper 1977) study, Sedlak and Weener (1973) have described the Auditory Reception, Auditory Association, and Grammatic Closure subtests as critical measures in the ITPA's relationship with achievement and IQ.

> The central role of these three subtests has direct implications for (a) the prospects of differential diagnosis, (b) the structure of cognitive abilities in children, and (c) the nature of reading process. The Auditory Reception, Auditory Association, and Grammatic Closure subtests correlate highly with one another, and their intercorrelations are usually the three largest coefficients in an intercorrelation matrix of the ITPA subtests. They often define the first factor in factor analytic studies, and are more strongly correlated with measures of general mental abilities than are the other subtests. In studies which use the ITPA to predict academic achievement, these three subtests usually yield the highest predictive coefficients in the following order: Auditory Association, Grammatic Closure, and Auditory Reception. These three subtests distinguish between good and poor readers more consistently than other subtests. Likewise, they would distinguish better than other subtests among social classes and between Caucasian and non-Caucasian groups. Exceptions to each of these statements can be found in specific research studies, but the general trend is in the stated direction (Sedlak & Weener, 1973, pp. 146-147).

The WISC and Achievement

Sattler (1974) reported that correlations between the Wechsler Intelligence Scale for Children (WISC) full scale and measures of achievement ranged from .14 to .81, with a median correlation of .61. Littell (1960) reviewed a series of studies conducted over a ten-year period which correlated the WISC with measures of academic achievement. The samples included children described as "a highly select population," mental defective children, delinquent children, achievers, non-achievers, those referred for psychological study, and fifth grade children in Guam. The sample sizes ranged from 18 to 621 children. Only two of the studies utilized a sample size greater than 100 and none of the studies appear to have been for a predictive period greater than one year. The multiple R correlations for the WISC-Verbal Scale with various measures of academic achievement ranged from .09 to .80, with a median of .61 while those for the WISC-Performance Scale ranged from .14 to .76 with a median of .54. Littell (1960) states that, in general, it is safe to say that the WISC relates quite well to scores on certain types of academic achievement for certain groups of children. In addition, the Verbal Scale relates to tests measuring academic achievement better than the Performance Scale.

In a recent study, Egeland, DiNello, and Carr (1970) investigated the ability of the WISC, the Bender Visual Motor Gestalt Test, the ITPA, and the Harrison-Schroud Reading Readiness Test to predict the Metropolitan Achievement Test. The WISC, ITPA, Bender-Gestalt, and the Reading Readiness Test were administered during the early to mid-part of first grade while the achievement tests were administered at the end of first grade and third grade. The Pearson r correlations for the WISC full scale ranged from .20 to .30 for first grade achievement, and ranged from .26 to .43 for third grade achievement. Correlations for the ITPA composite ranged from .25 to .36 for first grade achievement and .32 to .43 for third grade achievement. The Bender-Gestalt correlations ranged from -.17 to -.29 for first grade achievement and -.16 to -.33 for third grade achievement. The Reading Readiness subtests correlations ranged from .14 to .61, with a medain of .36 for first grade achievement and ranged from .14 to .52, with a median of .30 for third grade achievement. In order to determine the best combination of test scores in predicting academic achievement in the first and third grades, multiple stepwise correlations were conducted. The multiple correlations for the first and third grades ranged from .67 to .80 with no overall difference in the correlations between first and third grades. The authors of this study note that in interpreting the results that a restricted range of scores should be considered as the sample had an average IQ of 112.9. Of importance in interpreting the multiple correlations was the fact that various combinations of subtests on the diagnostic measures predicting academic achievement in one area were not necessarily the same group of subtests that predicted academic achievement in another area. That is, the skills necessary for reading and math were not necessarily the same. Furthermore, different combinations of tests providing the best predictions in the same area were different at each grade level. In essence, the skills necessary for successful reading in first grade and successful math in first grade were not necessarily the same skills needed in third grade. Overall, the best predictor of academic achievement in the first grade was the Reading Readiness subtest whereas the best predictor for third grade achievement was the Reading Readiness subtest with certain subtests of the ITPA and the WISC adding additional predictive variance.

Parenthetically, it is interesting to note that while the Wechsler Intelligence Scale was ostensibly developed to predict academic achievement, there is a paucity of predictive validity studies of sufficient sample size and duration, despite the widespread use of this diagnostic instrument. Similarly, the ITPA is perhaps the most widely used test for assessment of language deficiencies but few predictive validity studies with adequate sample sizes have been conducted. In addition, the Peabody Individual Achievement Test (Dunn & Markwardt, 1970), which will be utilized in the current study, has not been the subject of substantial predictive validity studies. Several reasons exist for this lack of research, among them being the fact that developers of academic achievement tests typically do not conduct validity studies comparing their measures with other measures developed by competitors. The logistics and economics involved in maintaining a sample over a period of years are the overriding factors which limit predictive studies.

The Peabody Individual Achievement Test (PIAT) is also relatively new to diagnosticians, but over the past six years it has become increasingly used as an academic diagnostic instrument in individual assessment. The authors of the PIAT state that both the concurrent validity and predictive validity of this individual test instrument will need to be studied in relation to other measures of scholastic achievement and other measures of academic readiness. Dunn and Markwardt (1970) report that Sittlington (1970) compared the PIAT with the WIDE Range Achievement Test (WRAT), utilizing 46 educable mentally retarded adolescents. The correlation of the PIAT Mathematics with WRAT Arithmetic was .58; PIAT Reading Recognition with WRAT Reading was .95; PIAT Spelling with WRAT Spelling was .85; PIAT Reading Comprehension and PIAT General Information had no direct WRAT counterparts; the PIAT Reading Comprehension with WRAT Reading correlated .90; the PIAT General Information had an expected low correlation with each of the WRAT subtests (.36 and below). These concurrent validity coefficients for the PIAT on this limited sample would seem to give an indication of substantial validity in predicting other academic achievement measures, at least for a retarded group.

Numerical Taxonomy

Numerical taxonomy is a measurement technique whereby the similarity between certain entities of concern can be determined and thereby ordered into a structure on the basis of this numerical similarity. Sokal and Sneath (1963) have defined numerical taxonomy as "the numerical evaluation of the infinity or similarity between taxonomic units and ordering of these units into taxa on the basis of their affinities" (p. 48). The purpose of a numerical taxonomy is to provide an empirical tool for isolating individuals in a large population with features in common. Numerical taxonomy or cluster analysis, a term which will be used interchangeably with the former throughout this paper, has certain underlying tenets which provide useful guidelines for researchers attempting to apply the procedures to practical situations.

1. Classification is best when the content of information is greatest and, therefore, should be based upon as many measurement characteristics as possible.
2. A priori, every characteristic or measurement is of equal weight.
3. The overall measured similarity between any two units or groups is based upon an index of similarity across the diverse characteristics which are being measured or compared.
4. The construction of the units is based upon a diversity of character correlations in the groups that are currently under study.
5. Numerical taxonomy or cluster analysis is considered to be an _empirical_ and _theoretical_ classification technique (cf., Sokal & Sneath, 1963, p. 50).

There are certain practical limitations to the empirical and theoretical nature of the numerical taxonomic techniques. The researcher brings certain cultural and conceptual biases to the study which determine the initial selection of a target sample. In addition, target samples which one wishes to study are of current social and research interest. For example, society may deem that certain populations possess relevant subpopulations which are in need of diagnostic/classificatory study such that more information about these subgroups can be gathered in an orderly manner.

Another bias which is inevitable in numerical taxonomic studies is the selection of measures from a vast universe of all possible measurements. Though a numerical taxonomist must initially consider that all variables be considered valid and of equal weight, he must construct a measurement set which he theoretically believes can diagnose and add additional information about the specific individuals or events under study. For example, the construction of the SCREEN battery, utilized in this study, required consideration of a diverse number of variables believed to be predictive of achievement in the early school grades. Whether or not the subgroup which derives from cluster analysis of the SCREEN variables differentially predicts measures of achievement is a totally empirical question. Theoretically, one can use measures which are highly related, i.e., have high intercorrelations, and bias the outcome of the clustering algorithm. The utility of such a selection would be limited in that it is unlikely that the subsequent cluster groupings would differentially relate to any criteria. Redundant overlapping measures add little to the utility of cluster procedures in discovering new information which is uniquely descriptive of a subpopulation.

Application of Cluster Analytic Research

Cluster analytic procedures have been used primarily in the biological sciences, genetics research, and medical diagnosis (Sokal & Sneath, 1963). With the development of more sophisticated cluster analytic programs for highspeed computers over the past ten years (Anderberg, 1973; Hartigan, 1975), social sciences have begun to utilize these procedures. Blashfield and Draguns (1976) have reviewed the numerical taxonomic criteria for adequate psychiatric classification procedures. Corning and Steffy (unpublished paper 1977) state that the major classification system for psychiatric nomenclature, DSM II and other systems, have been found wanting in numerous respects. Among the problems are (1) low reliability on general categories of psychopathology, interjudge agreement seldom exceeding 50% (Beck, 1962; Ward, Mendelson, Mack, & Erbough, 1962), and (2) inadequate coverage, that is, the degree to which characteristics or descriptors are applicable to individuals or behaviors being considered by diagnosticians (Blashfield, 1973).

The reasons for the problems with the psychiatric nomenclature are directly applicable to the difficulties with diagnosis and classification within education. Corning and Steffy (unpublished paper 1977) point to the fact that the systems have been created by consensus. Cromwell, Blashfield, and Strauss (1976) have also indicated that most diagnostic classification systems have "socio-political" underpinnings which represent diverse viewpoints requiring numerous compromises. Of major significance is the fact that behaviors which comprise psychiatric symptoms seldom have predictive utility. Strauss and Carpenter (1972) have reported that there is little or no relationship between psychiatric symptoms and major external criteria.

More closely related to psychoeducational evaluation and research is the possibility that the lack of reliability and validity in educational diagnosis has the disadvantage of channeling children into nonfunctional categories. The definition problems in the field of mental retardation (Dunn, 1963; Farber, 1968; Heber, 1970; Kirk, 1962; Robinson & Robinson, 1965) has produced prevalence surveys for mental retardation ranging from .16% to 23%. Similarly, these definitional problems have occurred in the field of learning disabilities. The redefining of mental retardation to exclude the 68-84 IQ borderline category (Grossman, 1973) and the recent attempt by Congress to limit the learning disability category to 2% of the population (Federal Register, 1976) has created a group of children who fall within an educational "gray area." These children typically have academic problems and need extra educational assistance but are not classified within a system which possesses adequate intervention correlates. A growing trend to label children in the 70-90 IQ range as learning disabled has resulted. The prime example of this growing trend is illustrated by the fact that a substantial number of children in the federally funded learning disability Child Service Demonstration Centers are underachieving in all academic subjects and have tested IQ scores below 90 (Kirk & Elkins, 1975); the implication is clearly that the Centers are serving a substantial portion of the low IQ children who exhibit a general learning problem.

The problem of reliably and validly diagnosing psychoeducational problems is directly applicable to study by numerical taxonomic techniques. The application of empirical grouping methods to learning problem children can be useful in defining more adequately diagnostic criteria for classification and for understanding criterion that can be selected among current measurement techniques. Also, empirical cluster analytic procedures can assist in uncovering previously unnoticed associations between variables and, to its greatest extent, provide a universally applicable classification system of greatest predictability for a large number of variables (Strauss, Bartko, & Carpenter, 1973).

Previous Relevant Cluster Analytic Research

Cluster techniques are relatively new to educational research and apparently nonexistent in isolating patterns or "profiles" on early identification screening test data and psycholinguistic measurement techniques. Although various investigations have presented empirical evidence that children with learning problems can be grouped into relatively identifiable diagnostic patterns, there has been relatively little success in establishing predictive relationships with these patterns (Elkins, 1972, 1973a, 1973b; McCarthy, 1973). Delineation of specific groupings or clusters of learning problem children could provide a means for identifying homogeneous groups for research purposes and also increase the efficacy in planning treatment programs. Part of the inconsistencies inherent in learning disability research has been the comparison of heterogeneous groups described by as many as 40 overlapping and inconsistent classification terms (Clements, 1966). Learning disabilities are typically defined by excluding other disorders such as mental retardation, sensory deficits, and demonstrable organic dysfunction (National Advisory Committee, 1968; Federal Register, 1976). Broadly worded definitions which result have the major disadvantage of being unreliable in practice, thus undermining the orderly accumulation of knowledge about the specific abilities/disabilities within categories. These broad classifications are neither practical nor do they represent useful schema for psychological research concerned with underlying processes involved in learning. The term "learning disabilities," thus, includes a heterogeneous group of disabilities and is not useful in providing remedial programming information for a given child nor in understanding the psychological dysfunction involved.

Recently, Luick (1975) has demonstrated that children who have displayed specific perceptual error patterns on a visual memory test could be grouped into homogeneous subclusters. The utility of the technique has apparent potential in isolating various types of "high risk" children based upon screening and diagnostic data. For example, Senf, Luick, and Larsen (1976) have been able to isolate consistent performance profiles among first graders in the SCREEN norm sample through the utilization of cluster techniques. Senf (1976) is convinced that the answer for seeking information about atypical functioning in extremely heterogeneous populations, "learning disabilities," does not lie with comparing convenient samples of so-called LD children (identified through vague criteria which is influenced by a host of local variables) with so-called normal children offered up to the researcher for comparison purposes. In particular, this type of research has been demonstrated to yield little information for the school, and provides no substantial assistance with the various facets involved in the process of education. Furthermore, Senf (1976) notes that the conclusions drawn from these convenient samples will vary primarily as a function of the specific samples and not as a function of the broader population to which the data are allegedly generalizable. The apparent power of the cluster technique lies in its ability in isolating target samples of children naturally derived from the broad range of children representing a diversity of potential performance patterns of the school population. If the subclusters which are isolated can be found to relate systematically to school achievement, diagnosticians and remediation specialists can provide more valid remedial programming information for each individual child. In addition, researchers in the field of education and related disciplines will be provided with a useful taxonomy with which to study the various psychoeducational functions and eventually etiologies of specific learning disability problems.

The power of the clustering procedure utilized in the latter studies as a classification technique was further illustrated with 240 diagnosed "aphasic" children who were found to have a common ITPA profile, a diagnostic indicator of "childhood aphasia" and/or other severe language handicaps (Luick, Agronowitz, & Busby, unpublished paper 1977). This V-shaped depression on the Auditory Association and Grammatic Closure subtests was obtained by 95% of the children from 40 districts, 80 classrooms, and tests were administered by approximately 40 different diagnosticians. Recently, Senf, Luick, and Larsen (1976, 1977) reported that consistent performance profiles could be isolated among the SCREEN norm sample population and that these deficit patterns were related to various school learning problems. The utility of the clustering procedure to be utilized in this study has the potential of isolating various types of "high risk" children based upon screening and diagnostic data.

The Distinction between Factor Analysis and Cluster Analysis

Cluster analysis is designed to yield groups of cases such that there is a similarity among case members and a difference between non-members. While cluster analysis is concerned with cases, factor analysis is typically concerned with the association between measures. The primary distinction between factor analysis and cluster analysis is that the latter is descriptive and taxonomic and does not assume a level more abstract than the actual data (Morf & Krane, 1973). Another important distinction between the two procedures is that factor analysis does not permit the isolation of relatively infrequent events. Low frequency events may be important psychoeducational dimensions and can become subsumed by the variance which is typically associated with high frequency events. For example, some particular measurement technique, e.g., a test of visual perception, may not relate throughout a random sample. However, the visual perception measure may show a high relationship over a a very specific range, noteably the severe deficit range, isolated through cluster analytic techniques.

The relevant issue here is that factor analytic research aimed at isolating dimensions of learning problems has not been particularly fruitful in special education. Problems with such studies often include the use of small samples and what might be termed convenience samples, locally obtained which are hoped to be representative of some larger unknown population of school children. Comrey, Senf, and Luick (unpublished paper 1975) have noted that samples primarily composed of learning problem children may yield a more complex factor structure than the total population which will aid in a more systematic classification in subsequent empirical study of these individuals.

In addition, these investigators have noted that the simplicity of this ability factor structure occurs with a large representative sample of school children. There is a very wide range of ability within the school population with only a relative small percentage of the subjects having some severe learning problems. A sample consisting only of individuals with assorted learning problems could be expected to produce a more complex factor structure, perhaps shedding light on the problem of how to classify individuals into categories. The data base of this study consists primarily of "normal" children and also children who have been noted through public school referral procedures to have educational difficulties of various kinds. Hence, by studying a large group of children who have been isolated through screening and referral procedures, the probability of identifying subgroupings which are characterized by achievement deficiencies is greatly enhanced. It is this type of research which will lend to the identification of psychoeducational correlates which characterize children with learning problems.

CHAPTER II

STUDY ONE

Method

To determine whether samples composed primarily of learning problem children would yield a more complex factor structure than that obtained in the total population, factor analyses were conducted separately on the SCREEN test and on the ITPA with the "high risk" samples and compared to those obtained using the comparison sample and parent sample which represented the total range of children attending public schools.

Subjects

A subsample of kindergarten and first grade children was selected from a total sample of approximately 3,500 children who received SCREEN in the spring of 1974. This total sample of 3,500 children was comprised primarily of children in suburban schools surrounding the Chicago area. The subsamples of 376 kindergarten and 388 first grade children make up the population for this study.

Table 1 summarizes the descriptive characteristics for the kindergarten population. There were 134 female and 242 male children in the kindergarten sample, with a mean age of 74.68 months (SD = 3.79) from 28

Table 1

Descriptive Characteristics for Kindergarten Population

		(%)
Age (in months):		
Mean	74.68	
Median	74.42	
SD	3.79	
Range	23.00	
Minimum	66.00	
Maximum	89.00	
Sex:		(%)
Females	134	35.6
Males	242	64.4
Total	376	
School Districts:		(%)
1	46	12.2
2	34	9.0
3	51	13.6
4	102	27.1
5	143	38.0
6	--	
Schools:	28	
Class Placement:		(%)
Regular	267	71.0
Open Space	109	29.0
Referral Category:		(%)
Teacher Referred	31	8.2
SCREEN Referred	102	27.1
Common Referral	59	15.7
Comparison Group	184	48.9
ITPA-Psycholinguistic Quotient (N = 376):		
Mean	105.01	
SD	13.14	
Range	83.00	
PIAT-Total (N = 375):		
Mean (scaled score)	100.27	
SD	10.41	
Range	66.00	

Table 1, Continued

SCREEN-General Readiness (N = 376):		
Mean (t score)	50.00	
SD	7.52	
Range	53.00	
WISC-Verbal (Pro-rated Total, N = 368)*:		
Mean (scaled score)	51.14	
SD	11.70	
Range	68.00	
VMI (N = 375):		
Mean (age score)	71.76	
SD	10.78	
Range	85.00	
Metropolitan Readiness Test (N = 207):		
Mean (raw score)	66.03	
SD	13.50	
Range	89.00	
Teacher Questionnaire (1974)		
Hearing Test Given:		(%)
Don't Know	17	4.7
No	9	2.5
Yes	339	92.9
Missing Data	11	
Hearing Problem Present:		(%)
Don't Know	94	25.8
No	264	72.3
Yes	7	1.9
Missing Data	11	
Vision Test Given:		(%)
Don't Know	17	4.7
No	9	2.5
Yes	339	92.9
Missing Data	11	
Vision Problem Present:		(%)
Don't Know	95	26.0
No	262	71.8
Yes	8	2.2
Missing Data	11	

Table 1, Continued

Medical Problem Present:		(%)
Don't Know	22	6.0
No	312	85.5
Yes	31	8.5
Missing Data	11	
Child's Ethnicity Different from Teacher:		(%)
Don't Know	56	15.3
No	252	69.0
Yes	57	15.6
Missing Data	11	
Number of Children in Household:		(%)
1	18	5.6
2	131	40.7
3	106	32.9
4	34	10.6
5	15	4.7
6	10	3.1
7	4	1.2
8	2	.6
9	2	.6
Missing Data	54	
Number of Older Siblings in Household:		(%)
0	112	35.1
1	102	32.0
2	63	19.7
3	18	5.6
4	13	4.1
5	6	1.9
6	2	.6
7	2	.6
8	1	.3
Missing Data	57	

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* WISC-Verbal Subtests (Comprehension, Similarities, Vocabulary, Digit Span)

different schools throughout five school districts. One can note that 29% of the kindergarten sample were in open space classrooms.

The subset of kindergarten children utilized in this report was comprised as follows: 8.2% of the subjects were referred by their teacher as children needing psychoeducational evaluation (Teacher Referred Group), 27.1% of the kindergarten children performed in the poorest 7% on one or more of the SCREEN subscales (SCREEN Referred Group), 15.7% of the children comprised a group consisting of both teacher referred and SCREEN referred subjects (Common Referral Group). The remaining 48.9% of the kindergarten sample consisted of children who were neither teacher referred nor SCREEN referred (Comparison Group). This Comparison Group was randomly selected from the total sample. The objective of this sample selection criteria was to generate a sample that was comprised primarily of children who were predicted to have some type of school problem in the early school grades. In addition, Table 1 provides the population data for the diagnostic tests which were administered. One can note that the means and standard deviations of the ITPA, PIAT, and WISC approximate their norm sample's central tendencies. Table 1 provides Teacher Questionnaire from 1974 descriptive information on whether or not hearing and vision tests were administered and whether there was a problem noted in these areas. The teacher also provided information on whether the school knew of a medical problem, child ethnic differences, number of children in the household, and number of older siblings in the household.

The first grade sample consisted of 148 females and 240 males with a mean age of 86.95 months (SD = 4.34) from 28 schools throughout six school districts (Table 2). Some 23.2% of this sample were in open space classrooms. The referral category subpopulations for the first grade consisted of: 14.4% Teacher Referred, 22.2% SCREEN Referred, 22.2% Common Referral, 41.2% Comparison Group. Similar to the kindergarten diagnostic data, the ITPA, PIAT, and WISC central tendencies approximate their respective norm populations. The 1974 Teacher Questionnaire information is also provided for the first grade population in Table 2.

Procedure

The subjects were administered the SCREEN instrument in late May of 1974 by their classroom teacher. While Project proctors witnessed the testing, they did not actively assist the teachers in the test administration but rather provided feedback to the proctor administrators. Concurrently, or within the following days, the child's regular classroom teacher completed an 80-item teacher rating scale on each pupil receiving SCREEN. The test items and the 80-item teacher rating scale used comprised the experimental version of the SCREEN 1974 edition.

Within two to four months, each of the children in this study was administered a battery of diagnostic tests by an Illinois state certified diagnostician. The Illinois Test of Psycholinguistic Abilities (ITPA), the Wechsler Intelligence Scale for Children-Verbal subscales of Comprehension, Similarities, Vocabulary, and Digit Span (WISC), the Beery-Butenika Visual Motor Integration Test (VMI), and the Peabody Individual

Table 2

Descriptive Characteristics for First Grade Population

Age (in months):		
Mean	86.95	
Median	86.85	
SD	4.43	
Range	38.00	
Minimum	72.00	
Maximum	110.00	
Sex:		(%)
Females	148	38.1
Males	240	61.9
Total	388	
School Districts:		(%)
1	--	
2	48	12.4
3	81	20.9
4	117	30.2
5	130	33.5
6	12	3.1
Schools:	22	
Class Placement:		(%)
Regular	298	76.8
Open Space	90	23.2
Referral Category:		(%)
Teacher Referred	56	14.4
SCREEN Referred	86	22.2
Common Referral	86	22.2
Comparison Group	160	41.2
ITPA-Psycholinguistic Quotient (N = 388):		
Mean	103.88	
SD	12.56	
Range	84.00	
PIAT-Total (N = 388):		
Mean (scaled score)	100.63	
SD	10.38	
Range	62.00	

Table 2, Continued

Descriptive Characteristics for First Grade Population

SCREEN-General Readiness (N = 388):		
Mean (t score)	49.99	
SD	7.93	
Range	55.00	
WISC-Verbal (Pro-rated Total, N = 381)*:		
Mean (scaled score)	52.04	
SD	10.64	
Range	60.00	
VMI (N = 388):		
Mean (age score)	82.60	
SD	16.82	
Range	108.00	
Metropolitan Achievement Test-Total Reading (N = 193):		
Mean (raw score)	46.21	
SD	12.12	
Range	74.00	
Metropolitan Achievement Test-Total Math (N = 194):		
Mean (raw score)	46.40	
SD	11.62	
Range	76.00	
Teacher Questionnaire (1974)		
Hearing Test Given:		(%)
Don't Know	19	5.2
No	3	.8
Yes	341	93.9
Missing Data	25	
Hearing Problem Present:		(%)
Don't Know	48	13.2
No	303	83.5
Yes	12	3.3
Missing Data	25	

Table 2, Continued

Descriptive Characteristics for First Grade Population

Vision Test Given:		(%)
Don't Know	18	5.0
No	3	.8
Yes	342	94.2
Missing Data	25	
Vision Problem Present:		(%)
Don't Know	44	12.1
No	298	82.1
Yes	21	5.8
Missing Data	25	
Medical Problem Present:		(%)
Don't Know	24	6.6
No	300	82.6
Yes	39	10.7
Missing Data	25	
Child's Ethnicity Different from Teacher:		(%)
Don't Know	21	5.8
No	284	78.5
Yes	57	15.7
Missing Data	26	
Number of Children in Household:		(%)
1	16	4.9
2	127	39.2
3	106	32.7
4	43	13.3
5	14	4.3
6	10	3.1
7	2	.6
8	1	.3
9	5	1.5
Missing Data	64	

Table 2, Continued

Descriptive Characteristics for First Grade Population

Number of Older Siblings in Household:		(%)
0	114	35.3
1	110	34.1
2	61	18.9
3	17	5.3
4	10	3.1
5	4	1.2
6	4	1.2
7	1	.3
8	2	.6
Missing Data	65	

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* WISC-Verbal Subtests (Comprehension, Similarities, Vocabulary, Digit Span)

Achievement Test (PIAT), and an experimental version of a Phonetics Test were administered.[2]

The parents of the children selected to be involved in this diagnostic follow-up sample were initially contacted by letter and subsequently by phone in order to obtain consent and arrange testing appointments. None of the parents, diagnosticians, or school officials were told which children comprised the "referral category groups." Instead, after the diagnostic testing had been completed, every parent was advised of his child's performance on the diagnostic measures by the diagnostician who conducted the testing or by a local school official.

Approximately 45 diagnosticians conducted the diagnostic follow-up in the summer of 1974. A quality control system was established which included a workshop reviewing the diagnostic instruments.[3] Each diagnostician was interviewed and was required to have state certification as a psychologist and/or diagnostician as well as a minimum of two years' practical experience in the school system. Furthermore, each testing session was tape recorded, the first two protocols being reviewed by a trained team which provided qualitative feedback to the examiners. After each diagnostician had completed approximately 75% of their workload, another two protocols were reviewed in order to assure quality performance. Under the direction of the Project administrators, a trained clerical team rechecked all scoring before data analysis was conducted. This total quality control process resulted in a rejection of approximately 2% of the protocols.

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[2] The experimental Phonetics Test was developed by Anthony H. Luick to assess basic phonetic skills including: Initial Consonants, Long & Short Vowels, Final Consonants, and Consonant Blends.

[3] Dr. Rolf Peterson, University of Illinois, Chicago Circle, acted as Director of Diagnostic Services and we are indebted to him for the development of the quality control system.

Psychometric Design of SCREEN

> To achieve differentiation of pupil skills in so many school-related areas without excessive testing time, SCREEN's subscales were designed to be easy for pupils who lacked significant deficiencies. SCREEN's purpose is to measure most accurately at the levels where a significant skill impairment is indicated. Consequently, overall item difficulty is low. The areas in which a given child has problems will be readily apparent. Although such a psychometric design necessarily reduces the magnitude of statistical relationships between SCREEN and tests which measure the full range of functioning (e.g., achievement tests), early identification of high risk pupils is better served by this approach (Senf & Comrey, 1975, p. 456).

Since the children in the current diagnostic sample received the experimental version of SCREEN in 1974, it was decided to rescore this version to approximate the 1975 version of SCREEN. This was accomplished by eliminating those experimental items in the SCREEN 1974 version which were no longer utilized in the 1975 version as the result of previous statistical analyses (Senf & Comrey, 1975). One should note that this rescoring did not significantly change the distribution characteristics of the data as the correlations between the experimental version of SCREEN 1974 in comparison to the rescored version approximating SCREEN 1975 range from .86 to .98, with only one scale being less than .90 and all correlations approximating the SCREEN 1975 norm sample reliabilities. Furthermore, the correlations of the SCREEN 1974 version and the SCREEN 1975 version with the criterion measures did not differ.

Procedure for Factor Analyses

For the total groups by grade, sex, and referral categories, factor analyses were conducted separately for the SCREEN variables and the ITPA variables. The nine SCREEN test major category scores were used excluding General Readiness as this is a combination of four of the SCREEN subtests. The SCREEN test raw scores were transformed into non-normalized t-scores (M = 50, SD = 10) retaining original distribution characteristics. Scaled scores for the 12 subtests of the ITPA were utilized for the factor analyses excluding the total ITPA score. For a detailed description of the ITPA subtests see Appendix B.

The factor analysis procedure which was utilized first computes the correlation matrix from the raw data by Pearson correlation coefficient. These matrices were then factor analyzed by the minimal residual method (Comrey, 1973).[4] This method of factor analysis requires no commonality estimates since it operates only on the off-diagonal correlation matrix entries. The minimal residual method of factor analysis ultimately reaches a point where no more factors can be extracted since the iterative process converges on vectors of opposite sign. When this occurs, there are no more factors of any consequence left in the matrix of residuals. In each of these analyses, factor extraction was continued until the iterative process terminated in this manner. The procedure provides for the computation of the correlation matrix, minimal residual factor extraction (Comrey, 1962; Comrey & Ahumada, 1964) and rotation by the normal varimax method (Kaiser, 1958).

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[4] These analyses were conducted under the supervision of Dr. Andrew L. Comrey at the University of California, Los Angeles.

The Teacher Referred, SCREEN Referred, and Common Referral Groups represent subsamples of this population of insufficient size for stable factor analysis. Small sample sizes tend to produce spurious correlations which are uninterpretable. Therefore, factor analyses were conducted utilizing the Total Group (within grade and sex), the Comparison Group, the Teacher Referred plus Common Referral Groups, and the SCREEN Referred plus the Common Referral Groups.

Results of Factor Analysis for SCREEN

The rotated factor matrix for the SCREEN test factor analysis by Total Grade and Grade-Sex Groups are reported in Table 3. Only two factors could be extracted by the minimal residual method. Factor I loadings for the kindergarten sample across Grade and Sex Groups are substantial and consistent with the significant loadings ranging from .37 to .75 for six variables. Throughout this study correlations of .30 or greater will be considered significant (Comrey, 1973). The Factor II loadings for the kindergarten sample are also substantial and similar across the total kindergarten sample and sex groups with four variables obtaining significant factor loadings ranging from .50 to .85.

The loadings for the first grade sample for Factors I and II are also substantial. For Factor I, the first grade Total Sample and Sex Groups produced significant loadings on the same four variables as those obtained in Factor II loadings of the kindergarten sample, ranging from .46 to .80. Conversely, the significant loadings for Factor II of the first grade Total Sample and Sex Groups are those which were obtained for Factor I of the kindergarten sample with the exception of the first

Table 3

SCREEN Test Factor Analysis,
Total Grade and Grade-Sex Groups

Variable	Kg. Total (N = 376)	Kg. Male (N = 242)	Kg. Female (N = 134)	First Total (N = 388)	First Male (N = 240)	First Female (N = 148)
Factor 1 Loadings						
Self Concept and School Adjustment	.46*	.46*	.44*	.13	.15	.03
Visual Skills	.67*	.62*	.75*	.04	.05	.01
Auditory Skills	.56*	.56*	.58*	.12	.09	.17
Figure Copying	.37*	.37*	.39*	.16	.13	.17
Basic Knowledge	.73*	.72*	.75*	.03	.04	-.00
Cognitive-Perceptual Skills	.61*	.56*	.70*	.67*	.65*	.69*
Behavioral Adjustment	.04	.02	.04	.46*	.48*	.49*
Social Adjustment	.17	.24	.12	.68*	.67*	.73*
Immaturity	-.09	-.09	-.07	.74*	.77*	.80*
Factor 2 Loadings						
Self Concept and School Adjustment	.01	.01	-.01	.15	.23	-.04
Visual Skills	.04	.03	.04	.42*	.48*	.34*
Auditory Skills	.02	.08	-.09	.57*	.60*	.49*
Figure Copying	.17	.15	.19	.33*	.30*	.36*
Basic Knowledge	.05	.03	.05	.71*	.68*	.77*
Cognitive-Perceptual Skills	.59*	.62*	.50*	.42*	.43*	.39*
Behavioral Adjustment	.48*	.49*	.55*	.06	.11	-.11
Social Adjustment	.68*	.65*	.71*	.14	.12	.20
Immaturity	.77*	.77*	.85*	.04	.02	.05

variable. The significant loadings for the first grade sample for Factor II are consistent across five variables ranging from .30 to .77. Although the significant Factor I loadings for the kindergarten sample are comparable to the Factor II loadings of the first grade sample, the significant correlations for first grade females in comparison to the correlations for the kindergarten females are somewhat reduced. In addition, the first variable in Factor II of the first grade sample does not produce significant loadings, whereas in Factor I of the kindergarten sample, the first factor does produce moderate size correlations.

The factor matrices for the SCREEN test factor analysis of the Comparison Group are provided in Table 4. For this group, two major factors were extracted and a minor third factor for the kindergarten sample. Factor I for the Comparison Group in kindergarten and in first grade is similar with significant loadings on the same four variables ranging from .43 to .82. These significant loadings are comparable to those which are obtained for the kindergarten Total Sample Factor II and those obtained for the first grade sample on Factor I, Table 3. Factor II loadings for the kindergarten and first grade samples are not as compatible as those obtained on Factor I nor those obtained for the Total Sample in Table 3. The significant loadings on Factor II for the kindergarten sample range from .37 to .70 on five variables, whereas those obtained on Factor II for the first grade Comparison Group sample are significant for three variables ranging from .37 to .56. Only the kindergarten sample for the Comparison Group produced significant loadings for Factor III. This is a relatively minor factor with significant

Table 4

SCREEN Test Factor Analysis,
Comparison Group

Variable	Factor 1		Factor 2	
	Kg. (N = 184)	First (N = 160)	Kg. (N = 184)	First (N = 160)
Self Concept and School Adjustment	-.07	-.01	.37*	.29
Visual Skills	.06	.19	.59*	.11
Auditory Skills	.00	.12	.49*	.56*
Figure Copying	.04	.03	.24	.37*
Basic Knowledge	.03	.11	.70*	.47*
Cognitive-Perceptual Skills	.69*	.82*	.42*	.24
Behavioral Adjustment	.43*	.47*	-.12	.08
Social Adjustment	.77*	.79*	.18	-.04
Immaturity	.72*	.80*	-.19	-.04

Variable	Factor 3	
	Kg. (N = 184)	First (None)
Self Concept and School Adjustment	-.23	
Visual Skills	-.12	
Auditory Skills	.03	
Figure Copying	-.39*	
Basic Knowledge	-.16	
Cognitive-Perceptual Skills	-.40*	
Behavioral Adjustment	-.36*	
Social Adjustment	.15	
Immaturity	-.07	

loadings on three variables ranging from .36 to .40. This third factor for the kindergarten subsample is not comparable to any factor obtained on the Total Sample in Table 3.

For the SCREEN test factor analysis on the Teacher plus Common Referral Group, four significant factors were extracted, Table 5. The first two factors are substantial whereas the third and fourth factors are relatively minor in loadings. Factor I significant loadings for kindergarten and first grade are relatively similar with the exception of one variable. Significant loadings range from .44 to .75 on four variables for the kindergarten group and from .62 to .75 on three variables for the first grade group on Factor I, Table 5. Once again, the important loadings for Factor I tend to be those same variables that were highly significant for Factors I and II for the kindergarten and first grade respectively in Table 3. However, two of the variables which produced loadings ranging from the high .40's to mid .70's in Table 3 now produced loadings ranging from .21 to .39. The significant loadings for Factor II in Table 5 range from .62 to .89 for two variables in kindergarten and first grade. Only two variables produced significant loadings for Factor III ranging from .36 to .70 for kindergarten and first grade, Table 5. For Factor IV, the significant loadings for the kindergarten sample ranged from .30 to .54 on four variables. However, only one variable for the first grade on Factor IV was significant with a relatively small loading of .31, Table 5.

Three significant factors were extracted for the SCREEN plus Common Referral Groups, Table 6. One can see an interaction effect

Table 5

SCREEN Test Factor Analysis,
Teacher Plus Common Referral Groups

	Factor 1		Factor 2	
Variable	Kg. (N = 90)	First (N = 142)	Kg. (N = 90)	First (N = 142)
Self Concept and School Adjustment	.24	.09	-.12	-.01
Visual Skills	.75*	.62*	-.02	.06
Auditory Skills	.67*	.61*	.06	.07
Figure Copying	.08	.14	.05	.05
Basic Knowledge	.49*	.75*	-.14	-.02
Cognitive-Perceptual Skills	.44*	.21	.28	.39*
Behavioral Adjustment	-.08	-.08	.26	.21
Social Adjustment	.22	.12	.62*	.71*
Immaturity	-.15	-.02	.89*	.78*

	Factor 3		Factor 4	
Variable	Kg. (N = 90)	First (N = 142)	Kg. (N = 90)	First (N = 142)
Self Concept and School Adjustment	.70*	.36*	-.03	-.08
Visual Skills	-.03	.02	-.31*	.01
Auditory Skills	.24	.22	.02	-.08
Figure Copying	.04	-.02	-.45*	-.08
Basic Knowledge	.04	-.01	-.54*	-.05
Cognitive-Perceptual Skills	-.06	.18	-.30*	-.31*
Behavioral Adjustment	.43*	.49*	-.05	.11
Social Adjustment	-.08	-.04	.15	-.15
Immaturity	.24	.24	-.26	.11

Table 6

SCREEN Test Factor Analysis,
SCREEN Plus Common Referral Groups

Variable	Factor 1 Kg. (N = 161)	Factor 1 First (N = 172)	Factor 2 Kg. (N = 161)	Factor 2 First (N = 172)
Self Concept and School Adjustment	.04	-.09	-.31*	-.03
Visual Skills	.55*	-.17	-.09	.27
Auditory Skills	.24	-.01	-.00	.47*
Figure Copying	.39*	-.02	-.02	.08
Basic Knowledge	.64*	-.02	-.21	.67*
Cognitive-Perceptual Skills	.57*	.39*	.33*	.28
Behavioral Adjustment	-.02	.21	.07	-.03
Social Adjustment	.02	.63*	.76*	-.08
Immaturity	-.03	.78*	.54*	-.22

Variable	Factor 3 Kg. (N = 161)	Factor 3 First (N = 172)
Self Concept and School Adjustment	.33*	.36*
Visual Skills	.39*	-.20
Auditory Skills	.55*	.04
Figure Copying	-.00	-.09
Basic Knowledge	.35*	-.16
Cognitive-Perceptual Skills	.01	.10
Behavioral Adjustment	-.37*	.61*
Social Adjustment	.03	-.11
Immaturity	-.35*	.21

occurring in comparing Factor I to Factor II in that the variables which produce significant loadings for the kindergarten sample on Factor I do not produce the same significant loadings for the first grade. The reverse effect occurs on Factor II with the first grade sample producing significant loadings on the variables that were significant for the kindergarten sample in Factor I, while the significant loadings for the kindergarten sample on Factor II are comparable to those that are significant for the first grade sample on Factor I. On Factor III for the kindergarten sample, there are four significant positive loadings and two significant negative loadings which produce an interesting interpretation which will be discussed below. In the first grade sample on Factor III, two loadings were significant which also have an interesting interpretation when considered in relation to Factor II.

Discussion

Two large consistent factors were obtained for the SCREEN test factor analysis on the Total Grade and Grade-Sex Groups, Table 3. For the kindergarten sample, Factor I significant loadings were on six variables including Self Concept and School Adjustment, Visual Skills, Auditory Skills, Figure Copying, Basic Knowledge, and Cognitive-Perceptual Skills. This same pattern of correlations were obtained on Factor II for the first grade sample with the exception that Self Concept and School Adjustment correlations were not significant. This factor can be said to represent general readiness since every child intellectual task and teacher ratings of cognitive-perceptual skills produced substantial loadings for the factor.

The second major factor interpretation is related to Factor II for the kindergarten sample and Factor I for the first grade sample in Table 3 which consistently produced large loadings on teacher ratings of Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment, and Immaturity. Since these variables are all teacher rating variables, the term teacher rating factor can be applied. This second factor tends to show considerable overlap for the teacher ratings, even though these traits which are rated are not considered to be highly related as each scale was factorally derived. It can be considered that this teacher rating factor has a considerable "halo" effect. Only the teacher ratings of Cognitive-Perceptual Skills produced large significant loadings on the general readiness factor. Of importance is the fact that the teacher ratings of Cognitive-Perceptual Skills also produced so much of the variance for the second factor along with the ratings of Social Adjustment, Immaturity, and Behavioral Adjustment.

One can conclude that teachers have a relatively good idea about the intellectual abilities of their students. However, teacher judgment tends to be clouded by other factors which can lead to serious mistakes in evaluating the aptitude of students. This exact effect was obtained in the factor analysis on the SCREEN norm sample (Comrey, Senf, & Luick, unpublished paper 1975). Teachers proved to underestimate the educational capabilities of a male child who was immature, had poor social skills, or who exhibited behavior problems that annoyed the teacher. Teachers also tended to overestimate the intellectual abilities of the female child who was socially skillful, cooperative, and mature for her age. The factor analysis which is presented in Table 3 represents a sample of children that contained the range of abilities that can be expected in the regular school population although over half the sample can be considered to represent children who may exhibit various types of problems in the school setting. The rather simplistic factor structure that was obtained can be representative of large samples of school children as compared to the more complex factor structures which were obtained on the referral groupings. The reason for these divergent factor results is that the general population contains a very wide range of abilities and disabilities with only a relatively small percentage of the subjects having a specific problem in some specific learning or personality area. The methods of factor analyses are not sensitive enough to isolate low frequency events which do not have strong correlations over random samples.

The factor analyses for the Comparison Group contains a sample of children who were neither SCREEN referred or teacher referred, theoretically representing a group that should have a relatively low probability of exhibiting school problems in the early grades, Table 4. Although the factor structure for Factor I for the kindergarten and first grade samples was similar to that obtained on the teacher rating factor in the total population, Factor II represents considerable diversity. The variables which are important for the total population in producing significant factor loadings (Table 3) tend to fall off in importance in Factor II for the first grade in Table 4. Visual Skills and teacher ratings of Cognitive-Perceptual Skills do not produce substantial loadings for the general readiness factor, leaving only the child test variables as significant indicators, Factor II (Table 4). Also of importance is the fact that the teacher ratings of Cognitive-Perceptual Skills produces a considerably smaller correlation for the kindergarten sample on Factor II (.42) as compared to loadings ranging from the mid .50's to high .70's for the general readiness factor in the total population, Table 3. The Visual Skills, Auditory Skills, and Basic Knowledge for the kindergarten sample, Factor II (Table 4), represent the more important variables which would be needed to examine such a sample. The variables that are of relative importance in the first grade are Auditory Skills and Basic Knowledge. These findings can be interpreted as indicating that the variables which are most important for predicting school achievement in kindergarten are not necessarily the same variables which will be of importance in the first grade.

Factor III, Table 4, is a relatively minor effect which has an interesting interpretation. Three variables produce negative loadings: Figure Copying (-.39), teacher ratings of Cognitive-Perceptual Skills (-.40), and Behavioral Adjustment (-.36). Such an effect may indicate that there is a group of children who exhibit behavior problems which tend to annoy the teacher with the implication that ratings of intellectual abilities tend to be downgraded on those children. It is of importance to note that teacher ratings used as the only criteria for evaluating the aptitudes of some students may produce serious mistakes.

The factor analysis described in Table 5 was conducted on a sample of children referred by the teacher for psychoeducational diagnosis and a group of children that were referred by the teacher and the SCREEN test with the major commonality of this subgroup being the teacher referral. Factor I is the strongest and most consistent for this group and can be described as a general readiness factor. Although this factor is similar to that obtained in the Total Sample in Table 3, there is the tendency for the teacher ratings of Cognitive-Perceptual Skills to produce a relatively small factor loading. The largest loadings for Factor I are produced on the child tests including Visual Skills, Auditory Skills, and Basic Knowledge. Interpretation of this factor would indicate that teacher ratings are not necessarily consistent with teacher referral patterns. Teachers refer children for psychoeducational diagnosis for a host of reasons, many of which are not related to the child's academic performance.

The remaining three factors in Table 5 provide an indication as to which variables underly the teacher's referral for psychological follow-up. Teacher ratings of Social Adjustment and Immaturity produced substantial loadings for Factor II. If the child is not socially skillful, cooperative, or mature for his age, there is a tendency for the teacher to refer this child for evaluation. Unfortunately, there seems to be relatively little correspondence between these two variables and the child's performance on school-related tasks (Factor II, Table 5).

The Factor III loadings produced an interesting effect with two variables indicating relative importance, Table 5. Self Concept and School Adjustment produced a relatively strong loading of .70 for the kindergarten sample corresponding to a moderate loading of .43 in teacher ragings of Behavioral Adjustment for the same grade. In comparison, the

Self Concept and School Adjustment variable falls off in importance in this factor in first grade with a loading of .36 and a corresponding significant loading in teacher ratings of Behavioral Adjustment of .49. It would seem that there is a segment of children that the teacher will refer who are relatively unruly and exhibit various types of behavioral problems in the school setting. Interestingly enough, these children also have relatively poor self concepts in kindergarten but apparently overcome these feelings by the first grade but still present behavioral difficulties in the classroom. Although the teacher will refer the child for psychoeducational evaluation, there seems to be little correspondence between their behavioral problems and academic skill areas. The child with behavioral problems presents a high profile in terms of what the teacher considers to be important in conducting a relatively smooth routine throughout the school day. In all probability, these children are corrected more often and have the corresponding feeling that the teacher may be down on them more than other children.

Factor IV is a relatively minor factor with moderate loadings on Figure Copying and Basic Knowledge and smaller loadings on Visual Skills and teacher ratings of Cognitive-Perceptual Skills and Immaturity, Table 5. These variables fall in importance for Factor IV in the first grade with only one variable retaining significance, teacher ratings of Cognitive-Perceptual Skills (.31). The implication of this factor may be that there is a group of children who fall in the lower age ranges for their grade and initially exhibit various kinds of academic problems due to some degree of immaturity. These underlying problems may cause the teacher to refer such a child for psychoeducational diagnosis. However, in the first grade the teacher still rates these children as having cognitive-perceptual problems, there being little correspondence between teacher rating referral and the child's performance in the academic areas. These results once again point to the implication that the reliance on only teacher ratings and teacher referral as a system for identifying children with problems in the early school grades can produce serious mistakes in evaluating the academic aptitudes of some children.

The factor analyses which are presented in Table 6 represent a group of children who fall in the lowest 7% in performance on the SCREEN child tests and on the SCREEN teacher ratings. In addition, these are children who are both referred by the screening procedure and referred by the teacher for psychoeducational follow-up procedures with a group commonality of low performance on at least one of the SCREEN scales. Three factors were of significance in this sample. Factor I for the kindergarten sample can be considered to be a general readiness factor with the child test variables of Visual Skills, Auditory Skills, Figure Copying, and Basic Knowledge producing the significant loadings along with teacher ratings of Cognitive-Perceptual Skills. This is comparable to the general readiness factor which was obtained for the Total Sample, Table 3, and compatible with the general readiness factors obtained for the Comparison and Teacher Referral Groups. Similarly, Factor I for the first grade sample is comparable with the teacher rating factor which was previously described. The variables which are significant for Factor II reverse in the kindergarten and first grade samples in comparison to those obtained on Factor I. For the kindergarten sample on Factor II, Social Adjustment and Immaturity produced the significant positive loadings with a corresponding negative relationship to the child's Self Concept and School Adjustment. This teacher rating factor of Social Adjustment and Immaturity is similar to the teacher rating factor which was previously described for the Teacher plus Common Referral Groups, Table 5 (Factor II). This group of children is in the SCREEN Referred Group primarily because of the negative teacher ratings which are not related to performance on academic skills. Teachers attend to children who are not socially skillful or mature for their age with there being a corresponding negative effect on at least some of the children's self concept and ability to adjust to the kindergarten school curriculum. The interpretation of Factor I for the first grade can be said to be similar in that the emphasis is on teacher ratings of Social Adjustment and Immaturity. However, the first grade general readiness factor for this sample, Factor II (Table 6), places emphasis primarily on two child test variables, Auditory Skills and Basic Knowledge, indicating that those skills necessary for predicting school success differ for kindergarten and first grade.

Interpretation of Factor III (Table 6) is interesting in that the significant positive loadings for the kindergarten sample are on the child test variables including Self Concept and School Adjustment, Visual Skills, Auditory Skills, and Basic Knowledge. The significant negative loadings are on teacher ratings of Behavioral Adjustment and Immaturity indicating that there is a negative correspondence between the child's academic performance and teacher ratings of Behavioral Adjustment and Immaturity. The significant loadings in Self Concept and School Adjustment and teacher ratings of Behavioral Adjustment in Factor III for the first grade corresponded closely to the significant loadings in Factor III which were obtained in Table 5. Once again, this is a group of children who present disruptions in the classroom causing the teacher to perhaps overcorrect producing corresponding negative self concept. More than likely these may be emotionally disturbed children in need of special psychological assistance but not in need of academic remedial intervention.

In summary, the factor analyses on the SCREEN test for the various subpopulations and Total Group indicate that there is a strong general readiness factor which is an excellent measure of general ability. The second major factor consists of teacher ratings with substantial overlap, although the traits rated are presumed to be highly related. This latter effect indicates that there are considerable "halo" effects occurring in the teacher ratings. This teacher emphasis on behavioral adjustment, social skills, and maturity seems to produce unnecessary referrals which are not related to academic skill problems. The results indicate that some teachers do have a good idea about the intellectual capabilities of many of their pupils. However, their judgment can be biased by other factors which lead to serious mistakes. If one compares these results to those obtained in the study of the children in the SCREEN norm sample (Comrey, Senf, & Luick, unpublished paper 1975), the problem of reliance on teacher ratings and referrals as the only means of identifying learning problem children can be explained in a logical manner. Teachers are most apt to underestimate the intellectual capabilities of the male child who is immature, has poor social skills or exhibits behavior problems that annoy the teacher. These teachers are most likely to overestimate intellectual capabilities of the female child who is socially skillful, cooperative, and mature for her age (cf., Comrey, Senf, & Luick, unpublished paper 1975).

The more complex factor structures which were obtained in Tables 5 and 6 on groups of children consisting of individuals with possible assorted learning difficulties illustrates an important point. Samples consisting of a range of relatively "normal" performance patterns tend to produce simplistic factor structures which shed little understanding on the problem of classifying individuals with various types of learning deficits. In order to understand those variables which are important for classification, one needs to examine samples of the population which are more indicative of the type of problem which one is trying to understand or isolate. Since the factor analysis results which were obtained on the "high risk" samples in this study differ so dramatically from those samples containing the total range of performance, researchers need to exercise caution when studying various populations through factor analytic procedures. If a test is developed to isolate a certain subpopulation, then one should examine sufficient numbers of that population in isolation from samples representing more diverse ranges of behavior.

Results of Factor Analyses for the ITPA

The scaled scores for the twelve subtests of the ITPA were utilized in the following factor analyses. The varimax rotated factor matrix with Kaiser normalization (Comrey, 1973) for the Total Grade and Grade-Sex Groups are presented in Table 7. For the purpose of this study, a loading of .30 will be considered significant (Comrey, 1973). For the total kindergarten and first grade groups, the significant factor loadings are consistent across six variables ranging from .41 to .71, Factor I (Table 7). The major significant loadings for the kindergarten male and female groups are also consistent ranging from .42 to .71 on the same variables as the total kindergarten group. The significant loadings for the first grade Sex Groups are also relatively large and consistent across six variables with the exception of two loadings which decrease in the first grade male sample, as compared to the total first grade sample and first grade female sample.

The significant loadings on Factor II for the kindergarten sample are moderate and relatively consistent for four variables across the Total Sample and Sex Groups in kindergarten. However, there are three variables which have minor significant loadings but contain inconsistencies across groups. The significant loadings for Factor II are relatively moderate ranging from .30 to .56 in the kindergarten sample. The significant loadings for the first grade sample on Factor II are also in the moderate range, ranging from .36 to .74. Factor loadings for the first grade Total Sample and first grade male sample are relatively consistent across variables and are consistent in comparison to the significant

Table 7

ITPA Factor Analysis, Total Grade and Grade-Sex Groups

Variable	Kg. Total (N = 376)	Kg. Male (N = 242)	Kg. Female (N = 134)	First Total (N = 388)	First Male (N = 240)	First Female (N = 148)
Factor 1 Loadings						
Auditory Association	.65*	.58*	.68*	.61*	.69*	.72*
Auditory Sequential Memory	.41*	.42*	.47*	.52*	.32*	.58*
Auditory Reception	.53*	.55*	.44*	.30*	.32*	.42*
Visual Reception	.21	.12	.42*	.05	.06	.03
Visual Sequential Memory	.15	.23	.07	.01	.14	.02
Visual Association	.27	.23	.36*	.24	.29	.34*
Visual Closure	.10	.10	.19	-.01	.03	-.00
Verbal Expression	.23	.23	.25	.25	.04	.22
Grammatic Closure	.68*	.71*	.64*	.71*	.51*	.73*
Manual Expression	.13	.11	.11	.12	.09	.10
Auditory Closure	.51*	.51*	.56*	.44*	.17	.48*
Sound Blending	.55*	.60*	.53*	.54*	.15	.53*
Factor 2 Loadings						
Auditory Association	.32*	.40*	-.22	.53*	.38*	.26
Auditory Sequential Memory	.12	.04	-.22	-.03	-.10	.06
Auditory Reception	.25	.35*	-.08	.39*	.36*	.25
Visual Reception	.45*	.49*	-.35*	.43*	.49*	.10
Visual Sequential Memory	.34*	.20	-.56*	.38*	.43*	.25
Visual Association	.50*	.50*	-.47*	.46*	.40*	.27
Visual Closure	.44*	.35*	-.52*	.52*	.64*	.74*
Verbal Expression	.13	.08	-.14	.18	.28	.55*
Grammatic Closure	.24	.22	-.24	.22	.22	.05
Manual Expression	.18	.18	-.16	.23	.35*	.13
Auditory Closure	.18	.20	.04	.17	.21	-.05
Sound Blending	.22	.11	-.30*	.03	.06	.04

Table 7, Continued

Variable	Kg. Total (N = 376)	Kg. Male (N = 242)	Kg. Female (N = 134)	First Total (N = 388)	First Male (N = 240)	First Female (N = 14
Factor 3 Loadings						
Auditory Association	.19	-.16	.31*	.01	.26	.26
Auditory Sequential Memory	.09	.13	.03	.04	.35*	-.08
Auditory Reception	.19	-.10	.35*	.06	.15	.05
Visual Reception	.14	.15	.12	.17	.12	.64*
Visual Sequential Memory	.04	.11	.06	.13	.01	.13
Visual Association	.11	.08	.20	.04	.09	.33*
Visual Closure	.22	.31*	.13	.34*	.13	.07
Verbal Expression	.62*	.64*	.56*	.51*	.46*	.10
Grammatic Closure	.13	.12	.14	.15	.54*	.07
Manual Expression	.49*	.41*	.67*	.34*	.21	.33*
Auditory Closure	.26	.24	.36*	.16	.46*	.26
Sound Blending	.14	.13	.20	.23	.62*	.13

loadings in the kindergarten sample. However, only two variables in the first grade female sample on Factor II are significant in comparison to six variables for the first grade Total Sample and male sample.

Factor III is a relatively minor factor with two variables that consistently produce significant loadings ranging from .41 to .67 across the kindergarten sample. Within the first grade Total Sample and Sex Groups, two variables are relatively consistent with significant loadings which are comparable to the two major loadings in the kindergarten sample. However, there is considerable scatter with the remaining significant loadings ranging from .30 to .64 across six variables.

The ITPA factor matrices for the Comparison Group are presented in Table 8. The major factor loadings for the kindergarten sample are comparable to those obtained for the total kindergarten group in Table 7. Seven variables produced significant loadings ranging from .36 to .70 with only four of these variables remaining significant for the first grade sample on Factor I in the Comparison Group. On Factor II in the Comparison Group there is relatively little consistency across variables with significant loadings ranging from .32 to .52 for the kindergarten and first grade samples. Only the first grade sample produced a significant third factor with loadings ranging from .30 to .56 on six variables.

For the Teacher Referred and Common Referral Groups, three factors were obtained with moderate loadings for kindergarten and first grade and an additional factor was obtained for the kindergarten sample, Table 9. On Factor I, the kindergarten sample obtained moderate loadings ranging from .33 to .55 on six variables while the first grade sample on

Table 8

ITPA Factor Analysis,
Comparison Group

Variable	Factor 1 Kg. (N = 184)	Factor 1 First (N = 160)	Factor 2 Kg. (N = 184)	Factor 2 First (N = 160)
Auditory Association	.68*	.74*	.28	.26
Auditory Sequential Memory	.38*	.17	.11	.52*
Auditory Reception	.56*	.52*	.29	.09
Visual Reception	.27	.28	.36*	-.05
Visual Sequential Memory	.24	.20	.23	.12
Visual Association	.36*	.39*	.25	.16
Visual Closure	.21	.17	.36*	-.11
Verbal Expression	.21	.07	.52*	.35*
Grammatic Closure	.70*	.52*	.19	.43*
Manual Expression	.10	.10	.52*	.14
Auditory Closure	.43*	.08	.44*	.32*
Sound Blending	.49*	.11	.36*	.56*

Variable	Factor 3 Kg. (None)	Factor 3 First (N = 160)
Auditory Association		.19
Auditory Sequential Memory		-.03
Auditory Reception		.19
Visual Reception		.36*
Visual Sequential Memory		.29
Visual Association		.33*
Visual Closure		.50*
Verbal Expression		.56*
Grammatic Closure		.11
Manual Expression		.42*
Auditory Closure		.30*
Sound Blending		.12

Table 9

ITPA Factor Analysis, Teacher Referred Plus Common Referral Groups

Variable	Factor 1		Factor 2	
	Kg. (N = 90)	First (N = 142)	Kg. (N = 90)	First (N = 142)
Auditory Association	.15	.51*	.23	.48*
Auditory Sequential Memory	-.02	.49*	.10	-.06
Auditory Reception	.19	.26	.06	.41*
Visual Reception	.11	.02	.49*	.51*
Visual Sequential Memory	.40*	-.06	.26	.41*
Visual Association	.11	.16	.58*	.45*
Visual Closure	.19	-.05	.52*	.54*
Verbal Expression	.55*	.23	.28	.06
Grammatic Closure	.33*	.72*	.24	.18
Manual Expression	.36*	.18	.33*	.26
Auditory Closure	.42*	.50*	-.00	.30*
Sound Blending	.44*	.53*	.01	.04

Variable	Factor 3		Factor 4	
	Kg. (N = 90)	First (N = 142)	Kg. (N = 90)	First (None)
Auditory Association	.73*	.16	.39*	
Auditory Sequential Memory	.16	.01	.50*	
Auditory Reception	.59*	.10	.22	
Visual Reception	.10	.09	.10	
Visual Sequential Memory	.11	.32*	.03	
Visual Association	.27	.03	.02	
Visual Closure	-.14	.41*	.14	
Verbal Expression	.06	.54*	.10	
Grammatic Closure	.22	.24	.66*	
Manual Expression	.18	.40*	.07	
Auditory Closure	.20	.00	.42*	
Sound Blending	.14	.23	.40*	

Factor I obtained moderate loadings ranging from .49 to .72 on five variables. There is relatively little consistency between the kindergarten and first grade significant loadings on Factor I. The significant loadings for Factor II in kindergarten and first grade showed considerably more consistency ranging from .41 to .58 on four variables with three other scattered variables producing significant loadings. The significant loadings for Factor III across grade also show relatively little consistency ranging from .32 to .73 on six different variables. Factor IV loadings are significant on five variables for the kindergarten sample while a significant fourth factor was not extracted for the first grade sample. The significant loadings for the kindergarten sample on Factor IV are comparable to the variables which are significant for the kindergarten sample, Factor I (Table 7).

The major factors for the SCREEN Referred and Common Referral Groups for the ITPA are presented in Table 10. There are three factors for kindergarten and first grade and a fourth factor for kindergarten. Factor I has major loadings on six variables ranging from .31 to .73 which are consistent across kindergarten and first grade. These significant loadings for Factor I are comparable to the significant loadings that were obtained in the kindergarten and first grade Total Sample, Factor I (Table 7). The Factor II significant loadings in Table 10 range from .34 to .55 and are consistent on four variables in kindergarten and first grade. Only two variables produced significant loadings ranging from .36 to .63 on Factor III for kindergarten and first grade.

Table 10

ITPA Factor Analysis,
SCREEN Referred Plus Common Referral Groups

	Factor 1		Factor 2	
Variable	Kg. (N = 161)	First (N = 172)	Kg. (N = 161)	First (N = 172)
Auditory Association	.47*	.65*	.17	.49*
Auditory Sequential Memory	.33*	.53*	-.00	-.07
Auditory Reception	.32*	.31*	-.03	.30*
Visual Reception	.27	.08	.34*	.41*
Visual Sequential Memory	.02	-.10	.53*	.49*
Visual Association	.08	.15	.41*	.52*
Visual Closure	.19	.04	.40*	.55*
Verbal Expression	.27	.17	.09	.12
Grammatic Closure	.69*	.73*	.22	.12
Manual Expression	.08	.17	.14	.23
Auditory Closure	.55*	.59*	.01	.13
Sound Blending	.50*	.55*	.16	.05

	Factor 3		Factor 4	
Variable	Kg. (N = 161)	First (N = 172)	Kg. (N = 161)	First (None)
Auditory Association	.25	.06	.47*	
Auditory Sequential Memory	.14	.06	.24	
Auditory Reception	.18	.12	.56*	
Visual Reception	.09	.06	.34*	
Visual Sequential Memory	.03	-.00	.04	
Visual Association	.16	.05	.56*	
Visual Closure	.17	.36*	.07	
Verbal Expression	.56*	.63*	.13	
Grammatic Closure	.10	.13	.17	
Manual Expression	.63*	.02	.17	
Auditory Closure	.25	-.02	.11	
Sound Blending	.05	.25	.15	

Factor IV is also a relatively minor factor for the kindergarten sample with significant loadings ranging from .47 to .56 on three variables.

Discussion

The results of the factor analyses for the Total Grade and Sex Groups on the ITPA produced two very consistent factors and a relatively consistent minor third factor, Table 7. The significant loadings for Factor I in both kindergarten and first grade all were obtained on the Auditory subtests of the ITPA with the exception of the Grammatic Closure subtest. However, past research has indicated that the Grammatic Closure subtest is highly related to the Auditory Association and Auditory Reception subscales of the ITPA (Luick, Agronowitz, & Busby, unpublished paper 1977); Paraskevopoulos & Kirk, 1969). This first factor for kindergarten and first grade can be said to be indicative of a relatively pure auditory factor with grammatic closure having a representation level of commonality and a strong relationship to the auditory channel. In all probability, this relationship can be explained by a similarity in item technique. Factor I is also consistent with previous research in that the Grammatic Closure, Auditory Association, and Auditory Reception subscales account for the major portion of the variance, respectively (Sedlak & Weener, 1973). Factor II is of particular interest in relation to previous research. Rather inconsistent results have been obtained in studies reported by Sedlak and Weener (1973) in relation to obtaining a relatively consistent visual channel structure. There is relatively good consistency for the major loadings in Factor II falling across the visual subtests, including Visual Reception, Visual Sequential Memory, Visual

Association, and Visual Closure. It is only in the first grade female sample for Factor II that this consistency is decreased with the majority of the variance loading on the Visual Closure subtest. The purity of this visual channel cannot be overinterpreted as the Auditory Association and Auditory Reception subtests also produce moderate significant loadings with the kindergarten and first grade male groups.

The Factor III loadings for the kindergarten sample have also produced results which have not been particularly consistent throughout the research history of the ITPA, Table 7. The major loadings are on the Verbal Expression and Manual Expression subtests indicating evidence of an expressive process. The expressive process is said to be involved in the ability to use verbal and manual symbols in relating ideas. While this same result was obtained in the first grade sample, Factor III (Table 7), its consistency is not retained within the male and female groups. It may be that the consistency within the kindergarten male and female groups in comparison to that obtained in the first grade sample is a reflection of more stress being placed on tasks strongly related to the expression subtests when initially entering kindergarten. The inconsistency may also be related to the fact that there is a considerable range of ability represented in the total samples. Luick, Agronowitz, and Busby (unpublished paper 1977) have noted that factor studies on the ITPA have previously used heterogeneous samples and that there is no reason to assume that the results would be appropriate for groupings of exceptional children. The present sample contains a majority of children who are said to be at "high risk." There is sufficient variability in the total population which contributes to the difficulty in isolating a pure visual process in Factor II loadings and in isolating a pure expressive process in Factor III, Table 7.

The variability in factor structures, which were obtained in Tables 8-10, indicate how the variance in differing subpopulations can produce dramatically divergent results. The factor structure of the kindergarten sample of the Comparison Group for Factor I (Table 8) is comparable to the auditory channel factor obtained in the kindergarten Total Sample. The consistency in loadings in first grade did not hold for two of the variables, Auditory Closure and Sound Blending. There is also a lack of consistency across grade for Factor II in the Comparison Group. Factor II within the Comparison Group does not represent a factor structure that one can interpret as representing the underlying assumptions of the ITPA model. Factor III which was obtained in the Comparison Group was only significant for the first grade sample but does approximate a visual-motor channel of communication. The relative variability and lack of consistency in the factor structure of this "normal" subsample of the population is indicative of the factor analyses which were conducted on the norm sample of the ITPA. These factor analyses produced inconsistent results which were essentially uninterpretable leading to the statement that factor analysis on ITPA data would probably generate results serving to confuse rather than simplify and provide construct validity (Paraskevopoulos & Kirk, 1969).

The factor structure which was obtained for the Teacher Referred and Common Referral Groups in Table 9 also lacks consistency in

Factors I and III. However, Factor II can be interpreted as approaching a pure visual factor with the major loadings in both kindergarten and first grade falling on the four visual subtests of the ITPA. Factor IV is a relatively minor factor but is similar to the major factor that was obtained in the total sample representing a pure auditory channel for at least the kindergarten sample. Apparently the teacher referral process contributes to considerable variability on the ITPA variables because of the emphasis on behavioral, social competency, and age appropriate behaviors. However, there is more consistency on the two auditory and visual channel factors which can be interpreted in comparison to the relatively "normal" sample in Table 8.

In the referral groups the factor analysis for the ITPA on the SCREEN Referred and Common Referral Groups produced the most consistent results in terms of providing construct validity to the underlying model of the ITPA, Table 10. Factor I for the kindergarten and first grade samples can be interpreted as a pure auditory channel factor comparable to that which was obtained on the total kindergarten and first grade samples. Factor II in Table 10 produces consistent loadings for the visual subtests and can be interpreted as representing a pure visual factor. The first two factors in the SCREEN Referred Group account for the majority of the variance. These auditory and visual channel factors are more consistent and pure in comparison to similar factors in the total group, Table 7. The third minor factor can be said to represent the expressive process which underlies the model of the ITPA in that the major significant loadings fall on the Verbal Expression and Manual

Expression subtests, Table 10. The interpretation for this factor is comparable to that previously discussed for Factor III of the kindergarten sample in Table 7. The fourth factor was only significant in the SCREEN Referred sample for the kindergarten group. However, this factor can be said to represent the representational level of communication in the ITPA model in that the Auditory Association, Auditory Reception, Visual Association, and Visual Reception subtests produced the major loadings. The representational level requires the mediating process which utilizes symbols that carry the meaning of an object (Paraskevopoulos & Kirk, 1969). Since it is a relatively minor factor, one can state that while there is evidence for the existence of the representational level, its isolation as separate from the auditory and visual channels of communication would be difficult to obtain.

In summary, one can state that the evidence provided by these factor analyses on the ITPA contributes to the construct validity of this psycholinguistic assessment device. The regularity of the ITPA subtest intercorrelations in the total population of this study and the SCREEN Referred subpopulation sheds understanding on the theoretical assumptions which underly the psycholinguistic model. Essentially, three findings contributing to the construct validity of the ITPA are of importance: (1) the isolation of a relatively consistent and major auditory channel factor, (2) the isolation of a major visual factor, and (3) the isolation of a smaller but equally interpretable expressive process factor. The knowledge that various subpopulations can produce divergent and essentially uninterpretable factor analytic results should caution those who conduct research with this psycholinguistic assessment technique. The best results for the ITPA were obtained on the SCREEN Referred sample in comparison to the sample referred by teachers which produced less interpretable results. An inability to extract meaningful factors for the ITPA utilizing "normal" samples was illustrated in comparing the factor analytic results of the SCREEN Referred sample to the "normal" group. In general, one can conclude that the ITPA can best be utilized as a diagnostic instrument on children who are considered to be at "high risk" for achievement in the early school grades. It may be especially useful if one plans to utilize remediation materials that are centered around the auditory, visual, verbal expression and manual expression functions in children with learning problems.

CHAPTER III

STUDY TWO

Method

The purpose of this study is to examine the concurrent validity of the SCREEN test and the ITPA in relation to group achievement and other individual diagnostic measures.

Subjects

This study will utilize the total kindergarten and first grade sample which was described for Study One. The descriptive characteristics of this population have been presented previously in Tables 1 and 2 (pp. 32 and 37, respectively).

Procedure

The data collection procedure for this study is the same as that which was described in Study One. The subjects were administered the SCREEN instrument in late May of 1974 by their regular classroom teachers. In the following days, the child's regular classroom teacher completed a teacher rating scale on each pupil receiving SCREEN. Metropolitan Readiness and Achievement data were collected by classroom teachers as a part of the regular school testing program for kindergarten and first grade pupils, respectively. Within two to four months, each of the children in this subsample was administered a diagnostic battery of tests by an Illinois state certified diagnostician: the Illinois Test of Psycholinguistic Abilities (ITPA), the Wechsler Intelligence Scale for Children--Verbal subscales of Comprehension, Similarities, Vocabulary, and Digit Span (WISC), the Beery-Butenika Visual Motor Integration Test (VMI), the Peabody Individual Achievement Test (PIAT), and the Experimental Phonetics Test.

In the first portion of this study the pattern of SCREEN subtest Pearson r correlations with the ITPA, WISC, VMI, age, sex, class placement (open space/regular), Metropolitan Readiness and Achievement Tests, PIAT, and the Phonetics Test will be examined within each grade. In addition to the nine major SCREEN variables which were previously described, the predictive validity of three other variables will be examined. These variables include: SCREEN General Readiness score (total of Visual Skills, Auditory Skills, Figure Copying, and Basic Knowledge), SCREEN Total Teacher Rating score (total of teacher ratings of Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment, and Immaturity), and the Optical Scan Figure Copying. This latter subtest includes the same items as the hand-scored Figure Copying subtest of the SCREEN 1974 version with the exception that these items are visually scanned by a television camera and subsequently scored through a complex computer procedure. The predictive validity of the hand scoring versus the optical scoring will be examined in this study.

In the second portion of the study, the ITPA subtest Pearson r correlations with the above criterion variables will also be presented within grade. To further assess the predictive utility of the screening and diagnostic procedures, the multiple regression correlations for

SCREEN and the ITPA in relation to one another and in relation to the PIAT, WISC, VMI, and Phonetics Test will be studied. In addition, the multiple regression correlations for the total SCREEN battery, ITPA, PIAT, and WISC will be examined in relation to the Metropolitan Readiness Test (kindergarten) and the Metropolitan Achievement Test (first grade). When any of the tests are utilized as predictor variables in the multiple regression equation, the total score associated with these tests is not utilized as this represents a duplication of the variance. Throughout this study, analyses were conducted by computer with the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1976). The abbreviations which will be utilized in the correlation tables for the SCREEN test and the ITPA are listed in Table 11. Throughout this study, correlations equal to or greater than .30 are considered significant (Comrey, 1973).

Results of SCREEN Pearson r Analyses

The SCREEN Pearson _r_ correlations for the kindergarten sample with the ITPA, WISC, VMI, age, sex, and class placement are presented in Table 12. The significant SCREEN correlations are low to moderate ranging from .30 to .48 with the ITPA subtests. In general, the teacher ratings of Behavioral Adjustment, Social Adjustment, Immaturity, and Total Teacher Ratings did not significantly correlate with any of the ITPA measures. The vast majority of the Optical Scan Figure Copying correlations are lower in comparison to the hand-scored Figure Copying subtest correlations with the ITPA. SCREEN's best predictors for the ITPA in decreasing order are Basic Knowledge, Visual Skills, General Readiness, Auditory Skills, teacher ratings of Cognitive-Perceptual

Table 11

Variable List for Correlation Tables

Variable Abbreviation	Variable Name
	SCREEN Test
SC-SAI	Self Concept and School Adjustment Index
Vis.	Visual
Aud.	Auditory
Fig. Cop.	Figure Copying (Hand Scored)
Bas. Kn.	Basic Knowledge
Gen. Rd.	General Readiness (Total of Vis., Aud., Fig. Cop., and Bas. Kn.)
TR-1	Teacher Ratings of Cognitive Perceptual Skills
TR-2	Teacher Ratings of Behavioral Adjustment
TR-3	Teacher Ratings of Social Adjustment
TR-4	Teacher Ratings of Immaturity
TR-T	Total Teacher Ratings (Total of TR-1, TR-2, TR-3, and TR-4)
Opt. Fig.	Optical Scan Figure Copying
	ITPA
Aud. As.	Auditory Association
Aud. S. M.	Auditory Sequential Memory
Aud. Rec.	Auditory Reception
Vis. Rec.	Visual Reception
Vis. S. M.	Visual Sequential Memory
Vis. As.	Visual Association
Vis. Cl.	Visual Closure
Ver. Ex.	Verbal Expression
Gra. Cl.	Grammatic Closure
Man. Ex.	Manual Expression
Aud. Cl.	Auditory Closure
Sd. Bl.	Sound Blending
PLQ	Psycholinguistic Quotient

Table 12

Concurrent Validity,
SCREEN _r_ Correlations with the ITPA, WISC, VMI, Age, Sex, and Class Placement
(Kindergarten)

	SC-SAI	Vis.	Aud.	Fig. Cop.	Bas. Kn.	Gen. Rd.	TR-1	TR-2	TR-3	TR-4	TR-T	Opt. Fig.
ITPA												
Auditory Association	.36*	.42*	.40*	.12	.44*	.29	.26	-.04	.11	.05	.11	.11
Auditory Sequential Memory	.24	.21	.19	.18	.22	.18	.26	.08	.05	.01	.15	.15
Auditory Reception	.26	.34*	.25	.13	.32*	.25	.22	-.05	.06	.02	.09	.08
Visual Reception	.07	.08	.18	.13	.20	.16	.08	-.09	.03	.06	.01	.10
Visual Sequential Memory	.16	.16	.20	.13	.28	.18	.22	.08	.12	.04	.17	.08
Visual Association	.19	.29	.32*	.25	.39*	.33*	.21	-.06	.09	-.02	.08	.10
Visual Closure	.18	.20	.11	.20	.34*	.24	.22	-.02	-.02	-.05	.06	.07
Verbal Expression	.11	.18	.05	.16	.20	.20	.15	-.10	.01	-.12	.01	.16
Grammatic Closure	.28	.41*	.42*	.18	.45*	.33*	.36*	-.09	.15	-.02	.16	.17
Manual Expression	.10	.21	.14	.13	.22	.22	.04	-.14	.00	-.17	.08	.16
Auditory Closure	.24	.34*	.25	.16	.32*	.26	.32*	-.04	.12	-.01	.14	.08
Sound Blending	.27	.34*	.31*	.20	.35*	.27	.37*	.01	.08	-.02	.17	.15
Psycholinguistic Quotient	.30*	.41*	.34*	.29	.48*	.41*	.32*	-.09	.10	-.06	.11	.22
WISC-Verbal**												
Comprehension	.16	.18	.16	.11	.22	.18	.14	-.07	.08	.02	.06	.01
Similarities	.23	.35*	.32*	.19	.38*	.33*	.25	-.01	.03	-.05	.09	.09
Vocabulary	.20	.27	.21	.21	.27	.29	.25	-.04	.14	.02	.14	.05
Digit Span	.28	.31*	.28	.17	.34*	.25	.34*	.06	.05	.03	.18	.12
Verbal IQ	.29	.38*	.32*	.23	.41*	.35*	.33*	-.02	.10	.01	.16	.09
VMI	.18	.25	.27	.49*	.42*	.44*	.33*	.11	.09	.09	.22	.33*

Table 12, Continued

	SC-SAI	Vis.	Aud.	Fig. Cop.	Bas. Kn.	Gen. Rd.	TR-1	TR-2	TR-3	TR-4	TR-T	Opt. Fig.
Age	.04	.11	.07	.08	.16	.10	.20	.03	.15	.10	.17	.08
Sex	-.06	-.02	.05	-.04	-.06	-.06	-.09	-.25	-.02	.08	-.10	-.08
Class Placement (Open Space/Regular)	-.01	-.07	-.11	.00	-.01	-.01	.05	.11	-.06	-.08	.02	.02

** WISC-scaled scores, pro-rated Verbal IQ

Skills, and Self Concept and School Adjustment, respectively. This correlation trend becomes evident when examining the SCREEN correlations with the total ITPA score--Psycholinguistic Quotient. The Visual Skills, Auditory Skills, and Basic Knowledge subtest correlations average in the mid .40's with Auditory Association, Grammatic Closure, and the Psycholinguistic Quotient.

SCREEN correlations with the WISC Verbal subtest present a similar pattern. The significant correlation of SCREEN with the WISC-Verbal subtests are all on the child tests and teacher ratings of Cognitive-Perceptual Skills. The best predictors of the WISC-Verbal subtests are: Basic Knowledge, Visual Skills, General Readiness, teacher ratings of Cognitive-Perceptual Skills, and Auditory Skills, respectively.

The SCREEN hand-scored Figure Copying subtest correlates significantly higher with the VMI (r = .49) in comparison to that (r = .33) for the Optical Scan Figure Copying measure. Basic Knowledge, General Readiness, and teacher ratings of Cognitive-Perceptual Skills also significantly correlate with the VMI. All of the SCREEN subtest correlations with age, sex, and class placement are not significant for the kindergarten sample.

The pattern of SCREEN correlations with the ITPA in the first grade sample is not similar to that which was obtained in the kindergarten sample. Only three SCREEN subtests have significant correlations with the ITPA subtests including Basic Knowledge, teacher ratings of Cognitive-Perceptual Skills, and Auditory Skills, Table 13.

Table 13

Concurrent Validity,
SCREEN r Correlations with the ITPA, WISC, VMI, Age, Sex, and Class Placement
(First Grade)

	SC-SAI	Vis.	Aud.	Fig. Cop.	Bas. Kn.	Gen. Rd.	TR-1	TR-2	TR-3	TR-4	TR-T	Opt. Fig.
ITPA												
Auditory Association	.10	.22	.32*	.13	.40*	.23	.35*	.00	.21	.15	.24	.11
Auditory Sequential Memory	.02	.08	.22	.12	.19	.16	.17	-.06	.07	-.04	.04	.03
Auditory Reception	.09	.11	.18	.09	.26	.13	.19	-.03	.13	.00	.10	.07
Visual Reception	.04	.15	.15	.08	.22	.10	.15	.08	.15	.13	.16	.09
Visual Sequential Memory	.03	.17	.09	.12	.19	.15	.19	.07	.11	.02	.13	.09
Visual Association	.07	.00	.21	.15	.35*	.22	.22	.06	.11	.05	.15	.07
Visual Closure	.01	.11	.14	.13	.27	.15	.11	.06	.11	.05	.11	.10
Verbal Expression	.07	.09	.10	.04	.17	.08	.20	.01	.10	.00	.11	.03
Grammatic Closure	.13	.19	.27	.13	.36*	.21	.36*	.04	.14	.09	.21	.13
Manual Expression	.01	.06	.08	.10	.14	.12	.03	-.07	.00	-.05	.03	.10
Auditory Closure	.08	.20	.25	.01	.23	.09	.27	.06	.18	.09	.20	.02
Sound Blending	.06	.14	.15	.07	.26	.11	.33*	.15	.13	.09	.24	.03
Psycholinguistic Quotient	.10	.20	.32*	.21	.45*	.29	.35*	.03	.20	.07	.25	.15
WISC-Verbal**												
Comprehension	.04	.04	.13	.11	.17	.15	.13	-.07	.06	-.03	.03	.10
Similarities	.06	.14	.26	.04	.23	.13	.11	-.06	.03	-.01	.02	.07
Vocabulary	.11	.13	.23	.11	.27	.19	.22	.01	.17	.06	.15	.11
Digit Span	.07	.09	.25	.22	.23	.25	.33*	.04	.19	.17	.21	.10
Verbal IQ	.09	.14	.30*	.13	.31*	.22	.27	-.03	.15	.01	.13	.11
VMI	.07	.20	.24	.40*	.31*	.44*	.25*	.12	.11	.15	.21	.28

Table 13, Continued

	SC-SAI	Vis.	Aud.	Fig. Cop.	Bas. Kn.	Gen. Rd.	TR-1	TR-2	TR-3	TR-4	TR-T	Opt. Fig.
Age	.03	-.01	.12	.05	.06	.07	.01	-.03	.07	.05	.03	.05
Sex	-.16	.02	-.06	.02	-.03	.02	-.10	-.24	.01	.16	-.07	.01
Class Placement (Open Space/Regular)	.01	-.07	-.11	-.03	-.11	-.02	-.05	-.01	-.01	-.03	-.03	-.02

** WISC-scaled scores, pro-rated Verbal IQ

The pattern of SCREEN correlations with the WISC is also not similar to those which were obtained in the kindergarten sample. For the first grade sample, only two subtests generally produce significant correlations including Basic Knowledge and Auditory Skills, Table 13. These correlations are in the low .30's in comparison to correlations with the WISC ranging from the low .30's to .40's for six variables across the kindergarten sample.

The trend of correlations with the VMI in the first grade are also lower in comparison to those obtained in the kindergarten sample. The best SCREEN predictors of the VMI for first grade are General Readiness, Figure Copying, and Basic Knowledge, respectively. Once again, the hand-scored Figure Copying correlation ($\underline{r}$ = .40) is significantly higher than the Optical Scan Figure Copying subtest correlation ($\underline{r}$ = .28) with the VMI.

The first grade SCREEN correlations with age, sex, and class placement are not significant.

SCREEN Pearson $\underline{r}$ correlations with the concurrent achievement and Phonetics Test are presented in Table 14 for the kindergarten sample. In general, the SCREEN skill tests and teacher ratings of Cognitive-Perceptual Skills are the best predictors for the Metropolitan Readiness Test. Self Concept and School Adjustment, teacher ratings of Behavioral Adjustment, Social Adjustment, Immaturity and the Total Teacher Rating score do not significantly predict the Metropolitan Readiness Test. The SCREEN subtests which best predict the Metropolitan Readiness Test with correlations ranging from .30 to .64 include: General Readiness, Basic

Table 14

Concurrent Validity, SCREEN r Correlations with Achievement Tests and Phonetics Test (Kindergarten)

	SC-SAI	Vis.	Aud.	Fig. Cop.	Bas. Kn.	Gen. Rd.	TR-1	TR-2	TR-3	TR-4	TR-T	Opt. Fig.
Metropolitan Readiness Test												
Word Meaning	.18	.39*	.28	.15	.29	.30*	.32*	-.17	.14	.00	.13	.05
Listening	.19	.28	.25	.15	.29	.27	.24	-.03	.09	-.04	.11	.06
Matching	.13	.28	.20	.35*	.40*	.40*	.40*	.09	.20	.04	.29	.25
Alphabet	.22	.37*	.27	.28	.25	.34*	.43*	-.07	.22	.02	.24	.19
Numbers	.22	.40*	.28	.42*	.46*	.50*	.47*	.06	.15	.05	.29	.25
Copying	.17	.33*	.17	.64*	.40*	.55*	.38*	.05	.05	.08	.23	.53*
Total	.24	.42*	.30*	.45*	.50*	.53*	.51*	.02	.21	.11	.32*	.29
PIAT												
Math	.33*	.46*	.34*	.27	.49*	.39*	.39*	.02	.10	.00	.19	.22
Reading Recognition	.25	.42*	.28	.28	.41*	.35*	.37*	.05	.03	.01	.18	.16
Reading Comprehension	.12	.16	.12	.08	.24	.17	.20	.04	-.05	.02	.06	.10
Spelling	.28	.40*	.30*	.27	.39*	.34*	.37*	.07	.03	-.02	.18	.17
General Information	.29	.41*	.31*	.21	.41*	.30*	.30*	-.05	.05	-.05	.10	.12
Total	.34*	.52*	.36*	.33*	.53*	.44*	.46*	.02	.08	.00	.21	.21
Phonetics Test (Experimental)												
Initial Consonants	.34*	.51*	.42*	.33*	.48*	.41*	.51*	.06	.17	.07	.30*	.22
Long & Short Vowels	.23	.37*	.28	.28	.42*	.38*	.44*	.10	.14	.13	.29	.16
Final Consonants	.32*	.54*	.37*	.36*	.56*	.47*	.57*	.08	.16	.07	.32*	.27
Consonant Blends	.30*	.48*	.36*	.38*	.54*	.49*	.51*	.07	.16	.09	.30*	.27
Total	.36*	.57*	.44*	.40*	.59*	.52*	.61*	.09	.19	.11	.36*	.27

Knowledge, teacher ratings of Cognitive-Perceptual Skills, Visual Skills, and Figure Copying, respectively. Also, the hand-scored Figure Copying correlation (r = .64) is significantly higher than the Optical Scan Figure Copying correlation (r = .53) with the Metropolitan Copying subtest.

For the kindergarten sample, the higher correlations ranging from .36 to .53 for the SCREEN subtests with the PIAT are on Basic Knowledge, Visual Skills, teacher ratings of Cognitive-Perceptual Skills, General Readiness, and Auditory Skills, respectively. The Self Concept and School Adjustment subtest also produced significant correlations (r = .33) with PIAT Math and (r = .34) with the PIAT total score. The remaining teacher rating subtests and the Optical Scan Figure Copying subtest do not produce significant correlations with the PIAT achievement test.

For the kindergarten sample, all the SCREEN child tests and teacher ratings of Cognitive-Perceptual Skills correlate significantly with the Experimental Phonetics Test. Significant correlations range from .30 to .61 with teacher ratings of Cognitive-Perceptual Skills being the best predictor followed by Basic Knowledge, Visual Skills, General Readiness, Auditory Skills, Figure Copying, and Self Concept and School Adjustment.

The SCREEN Pearson r correlations with the achievement tests and the Phonetics Test in the first grade are presented in Table 15. The general pattern of correlations in the first grade for these tests differ in comparison to that obtained in the kindergarten sample. In general,

Table 15

Concurrent Validity, SCREEN r Correlations with Achievement Tests and Phonetics Test (First Grade)

	SC-SAI	Vis.	Aud.	Fig. Cop.	Bas. Kn.	Gen. Rd.	TR-1	TR-2	TR-3	TR-4	TR-T	Opt. Fig.
Metropolitan Achievement Test												
Word Knowledge	.20	.17	.35*	.32*	.44*	.45*	.63*	.10	.23	.21	.41*	.12
Word Analysis	.17	.07	.31*	.32*	.41*	.41*	.59*	.11	.17	.14	.36*	.15
Reading	.27	.13	.34*	.31*	.47*	.43*	.56*	.13	.16	.17	.36*	.19
Total Reading	.28	.14	.36*	.32*	.47*	.46*	.61*	.13	.20	.19	.40*	.19
Total Math	.22	.13	.36*	.36*	.52*	.48*	.60*	.16	.25	.29	.45*	.31*
PIAT												
Math	.11	.26	.35*	.20	.44*	.30*	.46*	.10	.26	.26	.35*	.15
Reading Recognition	.13	.14	.27	.21	.36*	.27	.53*	.15	.17	.16	.35*	.13
Reading Comprehension	.06	.08	.24	.18	.30*	.26	.45*	.16	.19	.20	.34*	.11
Spelling	.09	.16	.27	.20	.34*	.25	.54*	.20	.22	.19	.39*	.12
General Information	.10	.21	.30*	.20	.42*	.29	.38*	.05	.27	.24	.31*	.17
Total	.12	.22	.36*	.24	.46*	.34*	.59*	.17	.28	.25	.43*	.17
Phonetics Test (Experimental)												
Initial Consonants	.07	.23	.18	.09	.27	.14	.34*	.06	.11	.07	.20	.07
Long & Short Vowels	.10	.21	.30*	.18	.36*	.25	.50*	.13	.16	.11	.31*	.10
Final Consonants	.07	.23	.31*	.10	.30*	.17	.44*	.19	.17	.12	.31*	.08
Consonant Blends	.06	.29	.37*	.14	.43*	.21	.54*	.18	.26	.21	.40*	.06
Total	.09	.30*	.37*	.17	.43*	.25	.58*	.18	.23	.17	.39*	.10

the significant correlations ranging from .31 to .63 increased in magnitude. In addition, for the Metropolitan Achievement Test the order of the scales which best predict the Metropolitan Achievement Test differ in the first grade in comparison to those which best predict with the Metropolitan Readiness Test in kindergarten. The teacher ratings of Cognitive-Perceptual Skills correlations range from .56 to .63 and the Basic Knowledge correlations range from .41 to .52 with the Metropolitan Achievement Test scales, indicating a considerable increase in the predictive power of these SCREEN scales for first grade. The Total Teacher Rating scale is also significant in relation to the Metropolitan Achievement Test, with the major portion of the variance in the scores being accounted for by one teacher rating scale, teacher ratings of Cognitive-Perceptual Skills. Teacher ratings of Behavioral Adjustment, Social Adjustment and Immaturity do not yield significant correlations. The hand-scored Figure Copying subtest significantly correlates with the Metropolitan Achievement Test, whereas the Optical Scan Figure Copying subtest does not produce significant correlations.

The pattern of SCREEN correlations with the PIAT in the first grade also differ in comparison to those which were obtained in the kindergarten sample. Teacher ratings of Cognitive-Perceptual Skills and the Basic Knowledge scale are the best predictors, respectively. Auditory Skills also yields significant correlations, whereas the Visual Skills subtest in the kindergarten sample was a major predictor scale for the PIAT.

In general, there is a decrease in the magnitude of the correlations between the SCREEN subscales and the Phonetic Test in the first grade, with teacher ratings of Cognitive-Perceptual Skills followed by Basic Knowledge and Auditory Skills being the best predictive scales.

Results of ITPA Pearson r Analyses

The ITPA correlations with the WISC, VMI, age, sex, and class placement are presented in Table 16 for the kindergarten sample. Typically, eight of the ITPA scales yield significant correlations with the WISC-Verbal subtests, including the total ITPA score. The Psycholinguistic Quotient is the best predictor of the WISC scales with correlations ranging from .40 to .63, followed by Auditory Association and Grammatic Closure. The Auditory Sequential Memory, Auditory Reception, Sound Blending, Visual Association, and Verbal Expression scales also yield significant but lower correlations in comparison to the Grammatic Closure and Auditory Association subtests.

The Visual Association subtest and PLQ yielded a low significant correlation ($\underline{r}$ = .30) with the VMI. All other ITPA scales are not significantly related to the VMI. In addition, the ITPA correlations with age, sex, and class placement for the kindergarten sample are not significant.

The ITPA Pearson $\underline{r}$ correlations with the WISC, VMI, age, sex, and class placement for the first grade sample are in Table 17. The pattern of significant correlations for the ITPA subscales with the WISC-Verbal scales is similar to that obtained in the kindergarten sample. The PLQ, Auditory Association, and Grammatic Closure subtests are the best

Table 16

Concurrent Validity, ITPA r Correlations with the WISC, VMI, Age, Sex, and Class Placement (Kindergarten)

	Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
WISC-Verbal**													
Comprehension	.36*	.24	.31*	.16	.11	.19	.16	.24	.29	.27	.27	.20	.40*
Similarities	.48*	.22	.42*	.19	.14	.31*	.21	.25	.49*	.21	.34*	.36*	.48*
Vocabulary	.41*	.23	.37*	.23	.13	.33*	.25	.26	.40*	.26	.30*	.35*	.49*
Digit Span	.44*	.58*	.36*	.15	.20	.22	.16	.18	.38*	.13	.26	.40*	.49*
Verbal IQ	.58*	.42*	.51*	.25	.19	.36*	.27	.32*	.53*	.30*	.41*	.45*	.63*
VMI	.19	.20	.13	.15	.22	.30*	.23	.11	.19	.07	.19	.18	.30*
Age	-.08	-.07	-.21	-.24	.00	-.07	-.08	-.18	-.14	-.05	-.14	-.21	-.18
Sex	.03	-.01	.10	.07	-.11	.06	-.07	.04	.07	.07	-.06	.00	.06
Class Placement (Open Space/Regular)	.01	-.01	-.01	-.08	-.06	-.04	.00	.08	-.08	.09	.00	-.03	-.01

** WISC-scaled scores, pro-rated Verbal IQ

Table 17

Concurrent Validity, ITPA r Correlations with the WISC, VMI, Age, Sex, and Class Placement (First Grade)

	Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
WISC-Verbal**													
Comprehension	.33*	.16	.25	.12	.00	.17	.25	.25	.27	.25	.20	.17	.37*
Similarities	.45*	.24	.31*	.12	.05	.16	.15	.22	.36*	.15	.25	.25	.42*
Vocabulary	.48*	.25	.32*	.16	.10	.17	.20	.29	.47*	.30*	.28	.27	.50*
Digit Span	.39*	.57*	.20	.05	.17	.18	.10	.23	.38*	.09	.25	.38*	.47*
Verbal IQ	.57*	.40*	.39*	.16	.09	.21	.24	.33*	.52*	.26	.33*	.37*	.60*
VMI	.16	.04	.08	.14	.20	.11	.17	.05	.11	.11	.01	.09	.19
Age	-.22	-.11	-.12	-.10	-.11	-.06	-.11	-.15	-.27	-.10	-.14	-.26	-.29
Sex	.09	-.05	.07	.11	-.03	-.02	.03	.01	-.03	.06	-.04	-.11	.05
Class Placement (Open Space/Regular)	-.10	-.04	-.13	-.02	.00	-.03	-.03	.02	-.12	-.04	-.03	-.10	-.10

** WISC-scaled scores, pro-rated Verbal IQ

predictors followed, in general, by the same subtests which yield significant correlations in the kindergarten sample. The only exception is that the Visual Association subtest for the first grade sample did not yield significant correlations with the WISC in comparison to the Visual Association subtest in the kindergarten sample. For the first grade sample, the ITPA correlations with the VMI, age, sex, and class placement are not significant.

The ITPA correlations with achievement tests and Phonetics Test for the kindergarten sample are presented in Table 18. Five ITPA scales produced significant correlations with the Metropolitan Readiness Test with the PLQ having the highest significant correlations ranging from .34 to .45. Grammatic Closure, Auditory Association, Auditory Reception, and Sound Blending subtests also produced significant correlations.

Eleven of the ITPA subscales have significant correlations with the PIAT subtests. The PLQ produces the highest correlations with the PIAT ranging from .44 to .65 followed in order by the Sound Blending, Grammatic Closure, Auditory Association, and Auditory Reception subtests which also yield moderate to high correlations.

Seven of the ITPA scales produce significant correlations with the Phonetics Test. It is important to note that six of the ITPA auditory scales yield the major significant correlations with the Phonetics Test. The best predictor of the Phonetics Test is the Sound Blending scale with correlations ranging from .34 to .54 followed by the PLQ, Grammatic Closure, Auditory Association, Auditory Reception, and Auditory Closure subtests, respectively.

Table 18

Concurrent Validity,
ITPA r Correlations with Achievement Tests and Phonetics Test
(Kindergarten)

	Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
Metropolitan Readiness Test													
Word Meaning	.41*	.14	.33*	.13	.03	.29	.21	.17	.41*	.12	.25	.23	.41*
Listening	.33*	.13	.24	.15	.09	.26	.10	.15	.22	.13	.21	.18	.34*
Matching	.14	.04	.07	.02	.26	.08	.11	.00	.25	.07	.10	.13	.13
Alphabet	.30*	.16	.30*	.05	.09	.20	.09	.15	.31*	.03	.22	.36*	.34*
Numbers	.34*	.21	.26	.07	.22	.22	.25	.20	.32*	.17	.27	.20	.42*
Copying	.18	.15	.14	.12	.17	.19	.12	.12	.23	.17	.20	.19	.29
Total	.36*	.21	.34*	.11	.23	.26	.21	.14	.35*	.20	.25	.23	.45*
PIAT													
Math	.51*	.30*	.44*	.25	.29	.33*	.26	.25	.50*	.18	.35*	.47*	.54*
Reading Recognition	.41*	.31*	.38*	.24	.20	.32*	.24	.27	.48*	.13	.38*	.53*	.49*
Reading Comprehension	.25	.22	.36*	.26	.11	.31*	.14	.30*	.32*	.20	.25	.39*	.44*
Spelling	.42*	.26	.41*	.27	.24	.27	.29	.29	.51*	.11	.39*	.53*	.51*
General Information	.59*	.34*	.51*	.30*	.14	.40*	.27	.36*	.53*	.29	.42*	.45*	.65*
Total	.57*	.37*	.52*	.30*	.25	.40*	.31*	.35*	.60*	.21	.47*	.60*	.65*
Phonetics Test (Experimental)													
Initial Consonants	.44*	.28	.32*	.21	.24	.31*	.23	.13	.44*	.09	.35*	.51*	.44*
Long & Short Vowels	.24	.18	.28	.11	.16	.31*	.16	.11	.31*	-.03	.19	.34*	.32*
Final Consonants	.37*	.25	.34*	.16	.26	.29	.25	.20	.44*	.05	.35*	.49*	.46*
Consonant Blends	.36*	.21	.34*	.21	.20	.32*	.22	.11	.40*	.03	.33*	.44*	.43*
Total	.43*	.29	.39*	.20	.25	.36*	.25	.16	.47*	.03	.37*	.54*	.49*

The pattern of ITPA subscale correlations with the Metropolitan Achievement Test differ in comparison to those that were obtained for the Metropolitan Readiness test in the kindergarten sample. Four of the ITPA subscales produce significant correlations with the Metropolitan Achievement Test, Table 19. The best predictor is the Grammatic Closure subtest with correlations ranging from .41 to .46 followed in order by Auditory Association, the PLQ, and Sound Blending.

Also, the pattern of ITPA subscale correlations with the PIAT differ in the first grade sample. Seven of the ITPA subtests yield significant correlations ranging from .47 to .63 for the PLQ. The Auditory Association, Grammatic Closure, Sound Blending, Auditory Closure, Auditory Reception, Auditory Sequential Memory, and Visual Association subtests also have significant correlations in the moderate range.

For the first grade sample, only three ITPA subtests yield significant correlations with the Phonetics Test in comparison to the six scales which yield significant correlations in the kindergarten sample. In general, the correlations are lower for the first grade sample with the Sound Blending subtest producing the highest correlations ranging from .28 to .50 followed by Grammatic Closure and Auditory Association, respectively. The PLQ for the first grade sample did not produce significant correlations with the Phonetics Test in comparison to the significant correlations which were obtained in the kindergarten sample.

Results of SCREEN Multiple Regression Analyses with the Diagnostic Tests

The multiple regression correlations for the SCREEN test with the ITPA, PIAT, WISC, VMI, and Phonetics Test are presented in Table 20 for

Table 19

Concurrent Validity,
ITPA r Correlations with Achievement Tests and Phonetics Test
(First Grade)

	Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
Metropolitan Achievement Test													
Word Knowledge	.40*	.21	.10	.04	.17	.25	.05	.21	.41*	.05	.23	.32*	.33*
Word Analysis	.30*	.20	.01	.03	.18	.24	.03	.17	.45*	.07	.19	.37*	.28
Reading	.38*	.16	.19	.10	.24	.31*	.09	.20	.43*	.11	.23	.25	.38*
Total Reading	.40*	.18	.13	.09	.24	.30*	.08	.20	.45*	.10	.24	.29	.37*
Total Math	.34*	.18	.10	.06	.24	.26	.12	.10	.46*	.07	.13	.16	.34*
PIAT													
Math	.57*	.36*	.35*	.25	.29	.31*	.19	.28	.57*	.18	.34*	.41*	.63*
Reading Recognition	.45*	.30*	.26	.15	.19	.28	.06	.30*	.54*	.11	.35*	.52*	.49*
Reading Comprehension	.47*	.30*	.25	.13	.13	.34*	.06	.27	.52*	.11	.34*	.43*	.50*
Spelling	.42*	.26	.23	.15	.23	.25	.10	.27	.48*	.09	.31*	.45*	.47*
General Information	.61*	.24	.39*	.28	.15	.30*	.18	.26	.51*	.22	.37*	.33*	.58*
Total	.59*	.34*	.35*	.23	.25	.35*	.15	.31*	.62*	.16	.39*	.52*	.62*
Phonetics Test (Experimental)													
Initial Consonants	.25	.14	.09	.09	.19	.11	.05	.15	.20	.09	.15	.28	.23
Long & Short Vowels	.30*	.20	.15	.07	.11	.16	.01	.18	.36*	.00	.24	.50*	.27
Final Consonants	.27	.16	.14	.09	.20	.12	.02	.14	.27	.04	.20	.37*	.25
Consonant Blends	.31*	.23	.10	.16	.15	.18	.01	.17	.34*	.03	.26	.42*	.26
Total	.35*	.23	.15	.13	.19	.18	.02	.19	.38*	.04	.27	.50*	.32*

Table 20

Concurrent Validity, Multiple R Correlations with Diagnostic Tests

	Kindergarten (N = 376)		First Grade (N = 388)	
	SCREEN (1974)	ITPA	SCREEN (1974)	ITPA
ITPA				
Auditory Association	.57		.50	
Auditory Sequential Memory	.34		.30	
Auditory Reception	.41		.33	
Visual Reception	.27		.27	
Visual Sequential Memory	.32		.28	
Visual Association	.46		.38	
Visual Closure	.39		.30	
Verbal Expression	.30		.26	
Grammatic Closure	.57		.47	
Manual Expression	.34		.19	
Auditory Closure	.44		.37	
Sound Blending	.49		.38	
Psycholinguistic Quotient	.57		.52	
PIAT				
Math	.58	.65	.57	.71
Reading Recognition	.53	.64	.59	.67
Reading Comprehension	*	*	.49	.64
Spelling	.53	.66	.58	.60
General Information	.51	.72	.52	.68
Total	.66	.77	.66	.76
WISC-Verbal				
Comprehension	.28	.45	.25	.45
Similarities	.45	.59	.32	.50
Vocabulary	.37	.54	.35	.58
Digit Span	.46	.67	.41	.65
Pro-rated Verbal IQ	.50	.72	.42	.69
VMI (Visual Motor Integration)	.57	.39	.49	.28
Phonetics (Experimental)				
Initial Consonants	.66	.61	.41	.36
Long and Short Vowels	.53	.47	.57	.55
Final Consonants	.71	.60	.51	.44
Consonant Blends	.66	.56	.63	.51
Total	.77	.66	.66	.58

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* The majority of the kindergarten sample did not receive this score.

kindergarten and first grade. Nine major SCREEN subtests were utilized as predictor variables in these analyses excluding the General Readiness score. For the kindergarten sample, the multiple R's for SCREEN with the ITPA subtests range from .27 to .57 with a multiple R of .57 for the Psycholinguistic Quotient. In predicting the twelve ITPA subtests, two to six of the SCREEN subtest predictors add significant unique variance to the multiple regression equation. For nine of the subtests, Basic Knowledge is the first variable to enter the equation and generally accounts for 50% to 60% of the total predicted variance. The next two variables that enter the multiple regression equation generally account for 30% to 40% of the remaining predicted variance. On the ITPA Auditory Reception subtest and Auditory Closure subtest the SCREEN Auditory Skills subtest enters the prediction equation first. Those variables which enter the prediction equation second include Visual Skills, Self Concept and School Adjustment, Visual Skills, teacher ratings of Cognitive-Perceptual Skills, Auditory Skills, Figure Copying, and teacher ratings of Immaturity, depending upon the particular ITPA subtest criterion. Across the thirteen ITPA criterion scores, it can be stated that all of the nine SCREEN predictor variables add significant unique variance to the prediction equation.

The SCREEN multiple R's with the ITPA range from .19 to .52 for the first grade sample and are generally lower in comparison to the correlations in the kindergarten sample. Generally, one to four SCREEN variables add significant unique variance to the prediction equation. The Basic Knowledge subtest enters the prediction equation first for nine of the ITPA variables, with teacher ratings of Cognitive-Perceptual Skills and Auditory Skills entering first for the remaining four variables. The second variable to enter the prediction equation is generally teacher ratings of Cognitive-Perceptual Skills, Visual Skills, Basic Knowledge, or Auditory Skills. The order with which the SCREEN variables enter the prediction equation differs by grade. For example, for the ITPA Psycholinguistic Quotient the variables which add significant unique variance for the kindergarten sample are, in order, Basic Knowledge, Visual Skills, Figure Copying, Behavioral Adjustment, Self Concept and School Adjustment, and Cognitive-Perceptual Skills, whereas in the first grade the variables which add unique variance are Basic Knowledge, teacher ratings of Cognitive-Perceptual Skills, Auditory Skills, and teacher ratings of Immaturity.

For the kindergarten sample, the SCREEN multiple R's with the PIAT range from .51 to .66 with either Basic Knowledge or the Visual Skills subtest entering the prediction equation first. On the average, three SCREEN variables add significant unique variance in predicting the PIAT subtests with the first two variables accounting for approximately 90% of the total predicted variance. The second variable to enter the euqation is either Basic Knowledge, Visual Skills, or teacher ratings of Cognitive-Perceptual Skills. In the first grade sample, multiple R's with the PIAT range from .49 to .66 with teacher ratings of Cognitive-Perceptual Skills or Basic Knowledge being the first variables to enter the prediction equation, accounting for over 50% of the total predicted variance. Basic Knowledge or teacher ratings of Cognitive-Perceptual

Skills make up the second variables which will add unique variance to the prediction equation for the first grade sample. For the PIAT subtests the order in which the SCREEN variables enter the prediction equation also differ by grade. Those variables which add unique variance for the kindergarten sample include Basic Knowledge, Visual Skills, teacher ratings of Cognitive-Perceptual Skills, and teacher ratings of Social Adjustment. Those variables which add unique variance for the first grade sample are teacher ratings of Cognitive-Perceptual Skills, Basic Knowledge, teacher ratings of Social Adjustment, Behavioral Adjustment, and Immaturity, and Auditory Skills. The multiple R's for SCREEN are in the same range for both the kindergarten and the first grade samples in predicting the PIAT subtests.

The SCREEN multiple R's with the WISC-Verbal subtests range from .28 to .50 with the Basic Knowledge subtest entering the prediction equation first for four of the variables and teacher ratings of Cognitive-Perceptual Skills entering first for the Digit Span subtest. These correlations are slightly higher than those obtained in the first grade sample for the WISC which range from .25 to .42 with Basic Knowledge, Auditory Skills, teacher ratings of Cognitive-Perceptual Skills entering the prediction equation first. For the kindergarten sample, the Visual Skills, teacher ratings of Cognitive-Perceptual Skills and Basic Knowledge subtests enter the prediction equation second in comparison to the first sample with Basic Knowledge, teacher ratings of Cognitive-Perceptual Skills and Auditory Skills generally entering the equation second. As in the above diagnostic tests, the first variable to enter the equation accounts for 50% to 60% of the total predicted variance with the second and third variables accounting for the majority of the remaining predicted variance.

The SCREEN multiple R with the VMI is .57 for the kindergarten sample and .49 for the first grade sample with the SCREEN Figure Copying subtest accounting for 80% of the predicted variance followed by Basic Knowledge and Auditory Skills.

The SCREEN multiple R's with the Phonetics Test range from .53 to .77 for the kindergarten sample. These are slightly higher than those obtained in the first grade sample which range from .41 to .66. For both the kindergarten and first grade samples, teacher ratings of Cognitive-Perceptual Skills and Basic Knowledge make up the first two variables to enter the prediction equation accounting for approximately 90% of the total predicted variance for the Phonetics subtests. Visual Skills, teacher ratings of Social Adjustment, Figure Copying, Self Concept and School Adjustment make up the remaining subtests which add unique variance in predicting the Phonetics subtests in kindergarten and first grade.

Results of ITPA Multiple Regression Analyses with the Diagnostic Tests

In these analyses the twelve ITPA subtests were utilized as predictors, excluding the Psycholinguistic Quotient, Table 20. The ITPA multiple R's for the PIAT range from .64 to .77 for the kindergarten sample and range from .60 to .76 for the first grade sample. In the kindergarten sample, generally four of the ITPA variables significantly account for the total variance in predicting the PIAT subtests. Auditory

Association, Sound Blending, or the Grammatic Closure subtests generally enter the prediction equation first accounting for 50% to 60% of the total predicted variance. Grammatic Closure and Sound Blending generally enter the prediction equation second followed by Auditory Reception or Auditory Association. These variables account for 30% to 40% of the remaining predicted variance. While two to four ITPA variables add significant unique variance in predicting the PIAT in the kindergarten sample, four to seven of the ITPA variables add unique variance in the first grade sample. Grammatic Closure or Auditory Association are generally the first or second variable to enter the prediction equation, accounting for approximately 50% to 60% of the total predicted variance. Auditory Association, Visual Reception, Visual Sequential Memory, Visual Association, Auditory Closure, and Sound Blending are the third and fourth variables which enter the prediction equation across the PIAT subtests, accounting for approximately 30% to 40% of the remaining predicted variance. All the ITPA variables with the exception of Manual Expression add unique variance to the regression equation for at least one or more of the PIAT subtests.

The ITPA multiple R's with the WISC-Verbal scales range from .45 to .72 for the kindergarten sample and range from .45 to .69 for the first grade sample. In the kindergarten sample, Auditory Association, Auditory Sequential Memory, and Grammatic Closure make up the subtests which enter the regression equation first, accounting for approximately 50% to 70% of the total predicted variance. The second variable to enter the prediction equation for the kindergarten sample generally includes Auditory Association, Sound Blending, or Manual Expression, accounting for the majority of the variance. In the first grade sample, Auditory Association enters the prediction equation first for four of the subtests and Auditory Sequential Memory enters first for the remaining subtests, accounting for approximately 50% to 70% of the total predicted variance. The second ITPA variable to enter the regression equation for the first grade sample is Auditory Reception, Grammatic Closure, Manual Expression, or Sound Blending, generally accounting for the majority of the remaining predicted variance. In both the kindergarten and first grade samples, four to seven of the ITPA subtests add significant unique variance in predicting the WISC-Verbal scales. Only the Visual Reception and Auditory Closure subtests do not add significant unique variance to the multiple regression equation in predicting the WISC scales.

The multiple R for the ITPA subtests with the VMI is .39 for the kindergarten sample in comparison to .28 for the first grade sample. Four ITPA variables including Visual Association, Visual Sequential Memory, Auditory Sequential Memory, and Visual Closure add significant unique variance for the kindergarten sample, while only the Visual Sequential Memory and Visual Closure subtests add significant unique variance for the first grade sample in predicting the VMI.

Sound Blending generally enters the prediction equation first for each of the Phonetics subtests accounting for approximately 75% of the total predicted variance. Those variables adding significant unique variance in predicting the Phonetics subtests in the kindergarten sample include Sound Blending, Grammatic Closure, Visual Association, Manual Expression, Auditory Association, Visual Closure, and Auditory Reception. In the first grade sample, Sound Blending, Auditory Association, Visual Sequential Memory, Visual Closure, and Grammatic Closure make up the subtests which add significant unique variance in predicting the Phonetics Test.

Results of Multiple Regression Analyses with the Metropolitan Tests

The SCREEN, ITPA, PIAT, and WISC-Verbal multiple R correlations with the Metropolitan Readiness Test are presented in Table 21. The multiple R's for SCREEN with the Metropolitan Readiness Test range from .37 to .69 with an average of .55 for the kindergarten sample. ITPA multiple R's range from .37 to .51 with an average of .42 with the readiness subtests. The PIAT multiple R's range from .50 to .71 with an average of .69 with the readiness tests. WISC-Verbal multiple R's range from .20 to .48 with an average of .36 with the readiness tests.

The Multiple R correlations with the Metropolitan Achievement for SCREEN, ITPA, PIAT, and WISC-Verbal scales for the first grade sample are in Table 22. The SCREEN multiple R's range from .70 to .73 with an average of .72 with the achievement test. ITPA multiple R's range from .53 to .56 with an average of .54 with the Metropolitan. The PIAT multiple R's range from .62 to .74 with an average of .70 with the achievement subtests. The WISC-Verbal multiple R's range from .34 to .40 with an average of .38 with the Metropolitan Achievement Test.

A comparison of the multiple R's for the screening and diagnostic measures in Tables 21 and 22 will be considered in relation to

Table 21

Concurrent Validity,
Multiple R Correlations with Metropolitan Readiness Test
(Kindergarten Sample)

Variable	SCREEN (1974) (N = 189)	ITPA (N = 376)	PIAT (N = 376)	WISC-Verbal (N = 189)
Word Meaning	.50	.51	.72	.38
Listening	.37	.37	.50	.29
Matching	.51	.37	.91	.30
Alphabet	.54	.45	1.00	.36
Numbers	.60	.46	.61	.47
Copying	.69	.32	.51	.28
Total	.65	.48	.60	.48

Table 22

Concurrent Validity,
Multiple R Correlations with Metropolitan Achievement Test
(First Grade Sample)

Variable	SCREEN (1974) (_N_ = 194)	ITPA (_N_ = 194)	PIAT (_N_ = 194)	WISC-Verbal (_N_ = 194)
Word Knowledge	.72	.53	.71	.34
Word Analysis	.70	.56	.74	.39
Reading	.70	.53	.68	.39
Reading (Total)	.73	.55	.74	.40
Math (Total)	.73	.54	.62	.40

differences associated with range restrictions, method variance, and item content in the following Discussion section. One should note that for the WISC kindergarten sample, the Similarities subtest generally enters the prediction equation first accounting for 90% of the variance with only the Vocabulary subtest entering second to add significant unique predictive variance. In the first grade sample for the WISC, the Similarities, Vocabulary, or Digit Span subtest enters the prediction equation first accounting for approximately 80% of the variance with either of these latter variables entering the prediction equation second and third, respectively, accounting for the majority of the remaining predicted variance.

For the PIAT kindergarten sample, the General Information subtest or the Math subtest enters the equation first accounting for approximately 50% of the variance, with all the remaining subtests generally adding almost an equal portion of the total remaining predicted variance. However, in the first grade sample, the PIAT Reading Recognition subtest enters the prediction equation first accounting for over 90% of the predicted variance with only one other variable adding significant unique predictive variance, Reading Comprehension or Spelling.

Discussion: SCREEN Concurrent Validity

Before discussing the relationship between SCREEN and the various diagnostic and achievement criterion measures, one should consider the psychometric characteristics of the SCREEN battery. The subscales of SCREEN were designed to measure most accurately at the levels where significant skill impairment may be indicated. Therefore, the overall item difficulty was low. Such a psychometric design necessarily reduces the magnitude of the statistical relationships between SCREEN and tests which measure a whole range of functioning (e.g., achievement tests and IQ tests). This design is reflected throughout the SCREEN subscales in that there is a high positive skew ranging from .45 to 1.34 in the kindergarten sample and ranging from .32 to 1.75 in the first grade sample on eight of the SCREEN subscales. Skewness is a statistic which determines the degree to which a distribution approximates a normal curve and will equal a value of zero when the distribution is a totally symmetric bell-shaped curve. The Figure Copying subtest within both grades has a more normal distribution which is probably a reflection of the hand scoring technique utilized for this subtest.

One should also note that six of the ITPA subscales are positively or negatively skewed, including Auditory Sequential Memory, Visual Reception, Visual Closure, Manual Expression, Auditory Closure, and Sound Blending with the remaining subscales having a relatively normal distribution. The WISC subtests have near normal distributions in both grades with the exception of the Digit Span subtest in the first grade sample which is positively skewed. Three of the PIAT subtests in the kindergarten sample are positively skewed while the remaining subtests in kindergarten and all of the subtests in the first grade sample have relatively normal distributions. Half of the Metropolitan Readiness subtests have high negative skews while the remaining subtests have relatively high positive skews. These distribution characteristics are important in that when one considers the correlational relationship between measures that have vastly different distributions the degree of relationship can be considerably reduced. In addition to distribution characteristics, one also should consider the relative reliability of the measures which are under consideration. The average split-half reliability across subscales for the tests in this study are: SCREEN (r = .87), ITPA (r = .71), PIAT (r = .69), WISC-Verbal IQ (r = .65), Metropolitan Readiness Test (r = .75), and Metropolitan Achievement Test (r = .92). When one measure does not significantly relate to another measure, it is not necessarily the predictor variable which is called into question as the other measure simply may not be an adequate criterion (cf., Campbell & Fiske, 1959). With these considerations in mind, the relationship of the various measures in this study will now be discussed.

The SCREEN Pearson r correlations with the ITPA subtests demonstrate that there is a moderate degree of relationship between these tests in the kindergarten sample and a considerably lower degree of relationship within the first grade sample. The significant positive correlations between SCREEN and the ITPA subtests range from .30 to .48 across six ITPA subtests in the kindergarten sample, Table 12. These subtests include the total Psycholinguistic Quotient, Grammatic Closure, Auditory Association, Visual Association, Sound Blending, and Auditory Closure, with the Psycholinguistic Quotient having the highest correlations and Auditory Closure the lowest. The Basic Knowledge subtest, Visual Skills, General Readiness, Auditory Skills, and teacher ratings of Cognitive-Perceptual Skills generally produce the highest correlations, respectively, within the kindergarten sample. Within the first grade sample, the degree of relationship between the SCREEN test and the ITPA is generally low with the majority of the correlations in the lower .30's, Table 13. Only the Basic Knowledge subtest (r = .45), teacher ratings of Cognitive-Perceptual Skills (r = .35), and Auditory Skills (r = .32) significantly relate to the Psycholinguistic Quotient within the first grade.

A similar grade difference is reflected in the multiple R correlations between the nine SCREEN predictors and the ITPA subtests as criterion variables, Table 20. The average multiple R's are approximately 30% higher for the kindergarten sample in comparison to the first grade sample across the twelve ITPA subtests. However, this grade difference is negligible for the SCREEN battery in predicting the ITPA Psycholinguistic Quotient.

There is also a considerable grade difference when one considers the SCREEN variables which add unique variance to the regression equation in predicting the ITPA subtests. Within kindergarten, the Basic Knowledge subtest, teacher ratings of Cognitive-Perceptual Skills, or Auditory Skills generally enter the prediction equation first accounting for more than 50% of the total predicted variance, with the Basic Knowledge subtest doing so for nine of the ITPA variables. Similarly, the same variables enter first for the first grade sample with Basic Knowledge doing so on eight of the ITPA variables. However, the difference between grade occurs when one considers the second variable that adds significant unique variance by grade. Within kindergarten, Visual Skills, Self

Concept and School Adjustment, teacher ratings of Cognitive-Perceptual Skills, Auditory Skills, Figure Copying, or teacher ratings of Immaturity represent the SCREEN variables adding significant additional variance to the multiple regression equation. Within first grade, teacher ratings of Cognitive-Perceptual Skills and Social Adjustment, Visual Skills, Basic Knowledge, or Auditory Skills represent the variables that add additional significant variance in predicting the ITPA. From two to six of the SCREEN variables with an average of four variables add significant unique variance across the ITPA subtests in the kindergarten sample. In comparison, from one to four variables enter the prediction equation in the first grade sample with an average of three variables adding significant predictive variance. Also, the order in which the SCREEN variables enter the multiple regression equation differs across variables and within grade. In general, it can be stated that within the kindergarten sample all of the SCREEN variables add significant unique variance to the regression equation in at least one or more of the ITPA criterion variables. Within the first grade sample, Self Concept and School Adjustment, Figure Copying, and teacher ratings of Social Adjustment are the SCREEN variables which do not add significant unique variance to any of the multiple regression equations associated with ITPA criterion.

The relationship between SCREEN and the ITPA diagnostic test can be summarized in the following manner. Within the kindergarten sample, five of the SCREEN variables demonstrate a moderate degree of relationship, while within the first grade sample only three variables yield significant but lower correlations, Table 12 and Table 13. A similar grade difference is reflected when one considers the total SCREEN battery multiple regression predictions for each of the ITPA subtests, Table 20. Within the kindergarten sample, all of the SCREEN variables demonstrated a degree of importance in adding significant unique variance in predicting the ITPA subtests. However, within the first grade sample, only six of the SCREEN variables demonstrate a unique predictive utility. The magnitude of the variance accounted for by each SCREEN variable differs within grade and across criterion measures. The major implication of these results is that the measured SCREEN skills necessary to predict performance on the ITPA in kindergarten do not necessarily correspond to the same skills in first grade.

In general, the Self Concept and School Adjustment index, teacher ratings of Behavioral Adjustment, Social Adjustment and Immaturity demonstrate little relationship to any of the ITPA subtests. The relationships that were obtained are not surprising when one considers the psychometric design of the SCREEN battery, the distribution characteristics of both measures, their respective reliability coefficients, item content differences, and the method variance associated with group administration versus individual administration. SCREEN was designed to assess readiness across a wide range of school skills, including personality assessment. However, the ITPA was designed as a diagnostic instrument for assessing more specific processes underlying the learning skills. Given these theoretical differences, one could not expect a high degree of relationship between these measures across the wide range of variance associated with each sample in this study. More homogeneous

SCREEN performance groups may prove to be strongly related to the processes underlying the ITPA. This empirical question will be addressed in a following study.

The relationship between the SCREEN subtests and the WISC-Verbal subtests is generally low with only one correlation being above .40 in the kindergarten sample, Table 12. However, there is a grade difference with more significant correlations ranging from .31 to .38 occurring in the kindergarten sample in comparison to first grade, Table 13. The Basic Knowledge subtest produces the highest correlation with the total Verbal IQ score (r = .41) for the kindergarten sample and (r = .31) for the first grade sample. The multiple R's between the SCREEN battery and the WISC-Verbal subtests range from low to moderate with an average of .41 for the kindergarten sample and .35 for the first grade sample, Table 20. In general, the Basic Knowledge subtest or teacher ratings of Cognitive-Perceptual Skills enter the multiple regression equation first, accounting for the majority of the predicted variance. Within the first grade sample, the Visual Skills subtest plays an important part in adding significant unique variance in entering the prediction equation as the second variable for the kindergarten sample in comparison to the Auditory Skills subtest which does so for the first grade sample. In both grades, an average of three SCREEN variables add significant unique variance in predicting the WISC-Verbal subtests.

In summary, there is a relatively low degree of relationship between the SCREEN battery as a whole and the WISC-Verbal scales. As such, it cannot be stated that the SCREEN battery is a major predictor of general intelligence. It is also important to note that there is no significant relationship between the SCREEN battery subtests with age, sex, or class placement, indicating that significant correlations obtained with the SCREEN subtests are not a function of variance associated with these latter variables.

The relationship between the SCREEN variables and the VMI in the kindergarten sample is significant for four variables including Figure Copying, General Readiness, Basic Knowledge, and teacher ratings of Cognitive-Perceptual Skills, respectively, Table 12. Within the first grade sample, teacher ratings of Cognitive-Perceptual Skills, Figure Copying and Basic Knowledge demonstrate a significant positive relationship to the VMI, Table 13. The multiple R for the SCREEN battery predicting the VMI is .57 for the kindergarten sample and .49 for the first grade sample, Table 20. This degree of relationship is not surprising in that the VMI is highly related to chronological age ($\underline{r} = .89$), whereas the SCREEN battery does not have a significant relationship with age. It is interesting to note that the hand-scored Figure Copying subtest accounts for 50% more of the variance in relation to the VMI in comparison to the Optical Scan Figure Copying subtest. One might assume that this relationship occurs because of the similarity in scoring methods between the SCREEN hand-scored subtest and the VMI. However, the correlations between the hand-scored subtest and the Metropolitan Readiness or Achievement Tests, the PIAT, and the Phonetics Test are significantly higher in comparison to those obtained with the Optical Scan Figure Copying subtest. While the optically scanned, computer scored Figure Copying technique has demonstrable reliability advantages over hand scoring, the human decision process apparently is a better predictor of school achievement.

The correlations with the SCREEN subtest with the Metropolitan Readiness Test are moderate to above average, ranging from .30 to .64 across five of the child tests and teacher ratings of Cognitive-Perceptual Skills, Table 14. The General Readiness score produces the highest correlations with the Metropolitan Readiness subtests followed by the teacher ratings of Cognitive-Perceptual Skills, Basic Knowledge, Figure Copying, Visual Skills, and Auditory Skills. In comparison, teacher ratings of Cognitive-Perceptual Skills correlations ranging from .56 to .63 with the Metropolitan Achievement subtests is the best SCREEN predictor, Table 15. The Basic Knowledge subtest and General Readiness score also produce significant moderate correlations with the Metropolitan Achievement Test with the Auditory Skills and Figure Copying subtests demonstrating a lower degree of relationship. This grade difference in prediction is also demonstrated in the multiple regression analyses for SCREEN with the Metropolitan tests, Table 21 and Table 22. The average SCREEN multiple R with the Metropolitan Readiness Test is .55 in comparison to an average correlation of .72 with the Metropolitan Achievement Test. The multiple R correlation in the first grade sample is not significantly different from that which was obtained in the SCREEN norm sample with the Metropolitan Achievement Test in first grade (cf., Summary of SCREEN Reliability and Validity Data, Appendix A). However, the multiple R correlation for the Metropolitan Readiness Test is considerably below that which was obtained in the norm sample (R = .67 for the subtest average and R = .86 for the total score). Lower correlations in the kindergarten sample may be the result of range restrictions associated with the "high risk" selection procedure in the current study. Also, the grade differences assoicated with the degree of variance accounted for by each SCREEN variable reflects changes in the underlying skills needed to assess kindergarten and first grade school skills.

The SCREEN total battery is the best predictor of the Metropolitan Readiness Test total score in comparison to the ITPA, PIAT, and WISC despite the fact that there is a high similarity in item technique between some of the PIAT subtests and the Metropolitan Readiness subtests. An item similarity may result in higher multiple R's for the PIAT with Matching, Alphabet, and Numbers subtests of the Metropolitan Readiness Test, Table 21. SCREEN multiple R's with the Metropolitan Achievement Test in first grade are relatively high averaging .72 but are not significantly different from an average of .70 obtained by the PIAT, Table 22. Generally, the SCREEN total battery does as well as or better than the individually administered diagnostic measures in predicting the Metropolitan series.

The correlations between the SCREEN subtests and the PIAT subtests are moderate to above average in both grades. Again, there are grade differences when one considers which SCREEN subtests are better predictors for this criterion measure. Within the kindergarten sample, the Basic Knowledge and Visual Skills significant subtest correlations range from .39 to .53 followed in order of decreasing correlations by teacher ratings of Cognitive-Perceptual Skills, General Readiness, Auditory Skills, and Self Concept and School Adjustment, Table 14. In the first grade, SCREEN correlations of teacher ratings of Cognitive-Perceptual Skills and Basic Knowledge are the more important predictors for the PIAT subtests with correlations ranging from .30 to .59, Table 15. The order in which the variables significantly enter the multiple regression equation are also indicative of grade differences with Basic Knowledge and Visual Skills entering the prediction equation first accounting for the majority of the variance in the kindergarten sample. Teacher ratings of Cognitive-Perceptual Skills and Basic Knowledge account for the majority of the multiple regression variance with the PIAT in the first grade. The order in which the remaining SCREEN variables add significant unique variance also differs within grade. However, the overall multiple R's for the SCREEN battery with the PIAT battery do not significantly differ within grade, ranging from .53 to .66 for the first grade sample, Table 20.

The positive relation between the SCREEN subtests and the Phonetics Test is substantial across the SCREEN child tests and teacher ratings of Cognitive-Perceptual Skills for the kindergarten sample, Table 14. Within the first grade sample, only teacher ratings of Cognitive-Perceptual Skills, Basic Knowledge, and Auditory Skills produce significant correlations with the Phonetics subtests, Table 15. This difference in correlations within the first grade sample is probably due to a ceiling effect occurring in the Phonetics subtests on Initial Consonants, Long and Short Vowels, and Final Consonants, with the majority of the first grade sample achieving near-perfect performance on these measures.

In summary, the results of this study indicate that the predictive power of the group administered SCREEN procedure compares favorably with that of the individually administered diagnostic instrument in most cases. The SCREEN test battery is an adequate to above average predictor of group administered and individually administered achievement tests. One should note that the combination of SCREEN subtests necessary to predict kindergarten performance differs from those needed to predict first grade performance. Results of the current study considered in conjunction with the SCREEN norm sample studies demonstrate substantial concurrent validity with group administered achievement measures. In addition, the individually administered WISC-Verbal scale is a very poor predictor of group achievement not only in comparison to the SCREEN battery but also in comparison to the other diagnostic measures. Since there is a low degree of relationship between the SCREEN battery and the WISC-Verbal subscales, one can state that the SCREEN battery procedure essentially is not a measure of general intelligence but more of an indicator of academic performance in the early school grades. This latter finding provides a substantial basis for labeling the major SCREEN factor found in previous factor analytic studies as "General Readiness" rather than "General Intelligence."

The predictive differences that occurred between the SCREEN battery and the group administered or individually administered diagnostic tests can be accounted for by one or more of the following facts:

1. SCREEN and the Metropolitan were administered by the classroom teacher in a group setting while the PIAT was administered by a diagnostician in an individual setting.
2. The PIAT testing was administered simultaneously with the diagnostic battery, both two to four months later than the SCREEN predictor.
3. The diagnostic predictors and the PIAT were administered in the same sitting by the same diagnostician.
4. The psychometric design of the SCREEN battery necessarily reduces the magnitude of statistical relationships between SCREEN and other tests which measure the whole range of functioning.
5. Similarity of item content increases the magnitude of the statistical relationship between predictor and criterion variables.

Thus, differences between the SCREEN variables and the diagnostic variables in predicting achievement could be due to the two to four month time lag between the SCREEN testing and the administration of the diagnostic battery. It could also be explained by the fact that the diagnostic battery and individual achievement measures were administered by the same person. Therefore, the differences in correlations between SCREEN and the diagnostic variables as predictors may well be due to method variance (i.e., individual versus group setting, specific administrators, or varying predictor-criterion test intervals) rather than any systematic variance relating to child skills or constructs under the test (cf., Campbell & Fiske, 1959).

In conclusion, it appears that the teacher group administered SCREEN battery predicts concurrent achievement test criteria and other measures almost as well or better than the individually administered diagnostic measures. When the group tests are used as criteria and when the time interval between the SCREEN testing and the criterion measurement is short, SCREEN predicts as well as or better than the much more expensive individually administered diagnostic test.

Discussion: ITPA Concurrent Validity

The ITPA Pearson r correlations with the WISC indicate that three scales produce the highest correlations in both grades, Tables 16 and 17. These scales include the Psycholinguistic Quotient, Auditory Association, and Grammatic Closure with correlations ranging from .52 to .63 with the total Verbal IQ score. These results are similar to previous studies which have correlated the ITPA with intelligence measures (Sedlak & Weener, 1973). Previous studies have found that other ITPA scales significantly correlate with measures of intelligence (Kirk & Kirk, 1978). In the current study, the Auditory Sequential Memory subscale, Auditory Reception, Sound Blending, Visual Association, and Verbal Expression subscales also produce significant positive correlations with the WISC-Verbal subtests in the kindergarten sample, Table 16. In the first grade sample, Auditory Sequential Memory, Auditory Reception, Verbal Expression, and Sound Blending significantly correlate with the WISC-Verbal scales, Table 17. The multiple regression analyses also indicate that there is a moderate to substantial relationship between the ITPA battery and the WISC-Verbal subtests with multiple R's ranging from .45 to .72 across both grades, Table 20. It is important to examine the order in which the ITPA subtests add significant unique variance to the multiple regression equation, as these results differ within subtests and across grade. Within the kindergarten sample, the Auditory Association subtest, Grammatic Closure subtest, or the Auditory Sequential Memory subtest enter the multiple regression equation first accounting for the majority of the predicted variance. In both grades, the Auditory Sequential Memory subtest accounts for the majority of the variance in predicting the Digit Span subtest contributing to the construct validity of this ITPA measure. Either the Manual Expression subtest, Auditory Association, Sound Blending, or Grammatic Closure subtest will enter the prediction equation second, predicting the majority of the remaining variance for the kindergarten sample. In the first grade sample, the Auditory Association subtest enters the multiple regression equation first accounting for the majority of the prediction variance on four WISC subtests including the total Verbal IQ score. Those variables which enter the regression equation second within the first grade sample in prediction of the WISC subscales include: Manual Expression, Auditory Reception, Grammatic Closure, or Sound Blending. In general, from four to seven of the ITPA subtests add significant unique variance depending on the criterion variable and grade. These grade differences indicate that the skills necessary to predict general intelligence in kindergarten are not necessarily the same skills which are necessary to predict intelligence in first grade. Previous studies have not been able to establish this principal for the ITPA as a predictor for insufficient sample sizes with variously related populations have been examined. Although this study agrees with the Sedlak and Weener (1973) review concerning the importance of the Auditory Association, Grammatic Closure, and Auditory Reception scales in predicting criterion measures, the current study also demonstrated that other ITPA measures demonstrate an equal or almost equal role in predicting general intelligence criteria. Therefore, the ITPA battery has a substantial relationship to measures of general intelligence. However, there is little or no significant relation between the ITPA battery and the VMI, age, sex, or class placement. Given the construction of the ITPA scaled scores, this result would be expected for the age and sex variables.

The Pearson r correlations between the ITPA subtests and the Metropolitan Readiness Achievement Tests are generally in the low to moderate range with five subtests having significant correlations in the kindergarten sample, and four subtests producing significant correlations for the first grade, Table 18 and Table 19, respectively. Within the kindergarten sample, the PLQ has the highest significant correlations ranging from .34 to .45 with the Metropolitan Readiness Test, while within the first grade sample the Grammatic Closure subtest has the highest correlations ranging from .41 to .46 with the Metropolitan Achievement Test. The multiple regression correlations for the ITPA battery with the Metropolitan series are low to moderate for the kindergarten sample ranging from .37 to .51, and are relatively higher ranging from .53 to .55 in the first grade sample, Table 21 and Table 22. In comparison to the WISC-Verbal scales, the ITPA is a significantly better predictor of kindergarten readiness and achievement in the first grade. However, the ITPA does not predict as well in comparison to the screening battery or the PIAT test as predictors of the Metropolitan series. There are two probable reasons for the relative differences in the multiple R's across measures. The first is related to method variance in that the SCREEN battery is group administered, whereas the ITPA is individually administered. As such the screening battery can be expected to relate more highly to group administered criterion and the ITPA would relate more highly to individually administered criteria. This method variance effect is also demonstrated if one compares the SCREEN multiple R's with the PIAT versus the ITPA multiple R's with the same criteria, Table 20. Method variance can have a considerable effect on the degree of relationship between predictors and criterion measures (cf., Campbell & Fiske, 1959). Secondly, the higher relationship of the PIAT battery as a predictor of group administered readiness and achievement tests in comparison to the ITPA is probably related to differences in item content. The PIAT test is designed specifically to measure the same type of content contained in group administered achievement tests. Thus, there is a high similarity between the items of the PIAT and the Metropolitan series. In comparison, the ITPA is not specifically designed to assess achievement but rather to assess the underlying processes which are related to language functions. When the design of the ITPA scales is considered in conjunction with its method of administration, moderate correlations with group administered achievement tests could be expected and were obtained in the present study.

A natural corollary of the above statement is that the ITPA should be more highly related to individual achievement measures. The Pearson r correlations between the ITPA subtests and the PIAT subtests range from low to above average in both grades, Table 18 and Table 19. Within the kindergarten sample, eleven of the ITPA scales produced significant positive correlations with the PIAT, whereas eight of the ITPA subtests produced significant correlations with the PIAT including the Psycholinguistic Quotient. Not only is there a grade difference in the number of scales with significant positive correlations, but there is also a grade difference in the relative strength of the relationship between the subscales. In the kindergarten sample, the Psycholinguistic Quotient produces the highest correlations ranging from .44 to .65 followed by the Sound Blending, Grammatic Closure, Auditory Association, and Auditory Reception subscales which have about equally high correlations. With the first grade sample, the Psycholinguistic Quotient, Auditory Association, and Grammatic Closure measures have equally high correlations with the PIAT followed by the Sound Blending subtest.

An examination of the ITPA multiple regression analyses with the PIAT also indicates that there is a difference across subtests and grade. Within the first grade sample, three of the ITPA subtests including Auditory Association, Grammatic Closure, or Sound Blending enter the prediction equation first accounting for more than 50% of the predicted variance, followed by Grammatic Closure or Sound Blending entering the second step of the prediction equation. Also, only two to four of the ITPA subtests add significant unique variance in predicting the PIAT subtests in the kindergarten sample. The picture is different for the first grade sample, with the Auditory Association and Grammatic Closure subtests entering the prediction equation first accounting for over 50% of the variance followed by one of the latter two subtests or Sound Blending. Within the first grade sample, from four to seven of the ITPA subtests add significant variance to the prediction equation across the PIAT subscales. This is another indication that measures necessary to assess school related skills in kindergarten are not necessarily the same measures which are needed to predict achievement in the first grade.

In summary, it should be noted that the ITPA is a relatively good predictor of the PIAT as the multiple R's are substanital within both grades ranging from .60 to .77, accounting for 36% to 59% of the possible predicted variance, Table 20. The ITPA is also a relatively good predictor of kindergarten and first grade Phonetics skills with differences in the Pearson r correlations and multiple regression analyses being related to a ceiling effect occurring in the first grade sample on the Phonetics measure. Previous research (Sedlak & Weener, 1973) has indicated that the ITPA subscales and total score are more highly related to math and science achievement tests than to measures of language (e.g., reading, spelling, word meaning, or word analysis). In the current study the ITPA has been found to be equally or almost equally related to math measures and measures of reading recognition, reading comprehension, spelling, and word skills.

In conclusion, another important result of these validity studies should be discussed. The multiple regression equations for both SCREEN and the ITPA have indicated that either all or the majority of their subtests add significant unique variance in predicting various criterion measures. Examination of the PIAT and the WISC-Verbal multiple regression equations in predicting the Metropolitan series presents a different picture. It is only within the kindergarten sample on the PIAT that a similar pattern appears, although the Math subtest enters each equation first accounting for 50% of the variance with the other measures accounting for approximately equal portions of the remaining variance. However, within the first grade sample, one subtest adds over 90% of the predicted variance for the PIAT, Reading Recognition, with the remaining minor variance being accounted for by only one or two other measures. In general, the WISC-Verbal scale is a relatively poor predictor of the Metropolitan series with the additional problem that one variable in both kindergarten and first grade accounts for 80% to over 90% of the predicted variance, the Similarities subtest. It is unlikely that the addition of the Performance subtests of the WISC would significantly change this picture (Littell, 1960). Evidence from this concurrent validity study indicates that there is little efficacy for utilization of the WISC as a differential predictor of early school performance.

CHAPTER IV

STUDY THREE

Method

The primary purpose of this study is to examine the predictive validity of the SCREEN test and the ITPA in relation to group achievement tests and teacher ratings of school skills which were administered in a 2½ year follow-up project. In addition, the predictive validity of the PIAT, WISC-Verbal, Phonetics Test, Beery VMI, Metropolitan Readiness Test (MRT), and Metropolitan Achievement Test (MAT) will be assessed in relation to the follow-up achievement and teacher rating data.

Subjects

Subjects who were administered the SCREEN instrument in late May of 1974 and also received diagnostic follow-up in the summer of 1974 make up the data base for the present study. Subsamples of the total kindergarten and first grade groups that were utilized in the two previous studies were selected for the following validity studies according to whether or not particular achievement test data or teacher rating follow-up data were available. The population characteristics of each validity study subsample will be described separately, prior to presenting the results for each criterion measure.

Procedure

Approximately 2½ years after the initial study, a research assistant collected available group administered achievement data from the school records. These achievement tests were administered in the middle of the third grade for the original kindergarten sample and in the middle of the fourth grade for the original first grade sample. In addition, a teacher rating questionnaire was completed on those children whose parents gave consent and whose teachers agreed to participate in the follow-up study. This dual consent requirement substantially reduced the number of follow-up questionnaires which were completed and reflects a stringent interpretation of recent privacy acts. Such stringent protection of school records is necessary but may act as a deterrent for needed longitudinal research. The follow-up teacher questionnaires were completed by the child's homeroom teacher, while the data portion of the form was coded by a trained research assistant (Appendix C). Complete follow-up achievement data was available on approximately 65% of the original 765 children in the diagnostic sample, including a 15% attrition rate due to transfers over the two-year period. Although the follow-up achievement data were available across five different achievement tests in both grades, reflecting differences in district practices, only the data from two of the achievement tests were of sufficient sample size for analyses in the kindergarten sample and three were of sufficient sample size for analyses in the first grade sample. The Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1976) was utilized for analyses in this study.

Due to teacher union by-laws, only two of the districts agreed to participate in the teacher follow-up questionnaire portion of the study. In these two districts, a letter was sent to each parent of the children in the original study describing the nature of the current project and requesting permission for the child's homeroom teacher to complete the questionnaire. In addition, when the parent gave permission for the child to participate, each teacher was given the option of completing the questionnaire. This dual consent requirement produced complete teacher follow-up questionnaire data for approximately 67% of the children that were available for participation. This percentage is as high as or considerably higher than most research surveys.

The major predictor variables for this study include the SCREEN test, ITPA, PIAT, WISC-Verbal subscales, VMI, MRT, and the MAT. The criterion variables include the SRA Assessment Survey (Level 2-E) and Cooperative Primary Test (kindergarten sample) and the Iowa Test of Educational Development (Level E/BL), the Stanford Achievement Test, and the Cooperative Primary Test (first grade sample), and the Teacher Follow-up Questionnaire (1977) data (Appendix C).

Results: Predictive Validity Study with the SRA Assessment Survey

The descriptive characteristics for the population of kindergarten children ($\underline{N}$ = 72) who received the SRA Assessment Survey in the middle of third grade are contained in Table 23. There are no major differences in this population in comparison to the total kindergarten population (Table 1) in general characteristics or on the diagnostic test

Table 23

Descriptive Characteristics of Sample for SRA Assessment Survey Level 2-E (Primary Edition), (Kindergarten Predictive Study--Third Grade)

Age (in months):	
Mean	73.7
Median	74.1
SD	3.3

Sex:		(%)
Females	25	34.7
Males	47	65.3
Total	72	

Class Placement:		(%)
Regular	72	100
Open Space	--	

Referral Category:		(%)
Teacher Referred	5	6.9
SCREEN Referred	19	26.4
Common Referral	11	15.3
Comparison Group	37	51.4

ITPA-Psycholinguistic Quotient:	
Mean	104.68
SD	10.29
Range	44.00

PIAT-Total:	
Mean (scaled score)	103.78
SD	9.64
Range	46.00

SCREEN-General Readiness:	
Mean (t score)	49.40
SD	9.55
Range	49.00

WISC-Verbal (Pro-rated Total):	
Mean (scaled score)	54.84
SD	10.27
Range	48.00

data. All the subjects in this study were assigned to regular classrooms while in kindergarten.

The Pearson r correlations for the total scores of the predictor variables, age, and sex with the SRA Assessment Survey criterion are presented in Table 24. Correlations with two types of scores on these achievement measures are reported (grade equivalent and growth scale value). There are no significant correlational differences between the scoring methods within identical subtests for each predictor variable. Pearson r correlations for the ITPA total score, the Psycholinguistic Quotient (PLQ), range from .36 to .58 with a mean r of .49 with these achievement criterion. The PIAT total score correlations are all above average ranging from .58 to .68 (mean r = .63). Correlations for the WISC Verbal IQ are all low ranging from .34 to .41 (mean r = .38) across the criterion variables. Also, the Pearson correlations for the VMI are all low ranging from .31 to .37 (mean r = .33) with the achievement subtests. The SCREEN General Readiness score correlations range from .44 to .53 (mean r = .49) across the subtests of the SRA Assessment Survey.

The multiple R correlations with the SRA Assessment Survey for the 2½ year follow-up are presented in Table 25. The total battery correlations for the SCREEN, ITPA, PIAT, and the MRT are all in relatively the same range (R = .73 to .77). The multiple R for the PIAT battery totally accounts for all the variance in predicting the Language Arts subtest, raising the average multiple R for this predictor to .77. Generally, the multiple R's for the WISC-Verbal battery are below average ranging from .37 to .51 (mean R = .45).

Table 24

Predictive Validity (2½ Years), Pearson r Correlations (Key Variables) with the SRA Assessment Survey Level 2-E (Primary Edition)+

	ITPA PLQ	PIAT Total	WISC-Verbal	Beery VMI	SCREEN General Readiness	Age	Sex
Composite (GE)**	.53*	.67*	.41*	.37*	.53*	.10	-.07
Reading (GE)	.58*	.63*	.37*	.34*	.50*	.03	-.09
Language Arts (GE)	.36*	.58*	.34*	.31*	.50*	.22	-.12
Math (GE)	.48*	.61*	.40*	.33*	.44*	.05	.01
Composite (GSV)***	.53*	.68*	.41*	.36*	.53*	.09	-.07
Reading (GSV)	.57*	.62*	.37*	.32*	.48*	.04	-.10
Language Arts (GSV)	.38*	.59*	.33*	.31*	.51*	.21	-.16
Math (GSV)	.48*	.62*	.40*	.33*	.44*	.04	.02

+ Pearson r correlations for class placement not calculated--all subjects in this sample were in regular classrooms in 1974.

** GE is defined as grade equivalent.

*** GSV is defined as growth scale value.

Table 25

Predictive Validity (2½ Years), Multiple R Correlations with SRA Assessment Survey Level 2-E (Primary Edition)

	SCREEN (1974) (N = 72)	ITPA (N = 72)	PIAT (N = 72)	Metropolitan Readiness (N = 50)	WISC-Verbal (N = 72)
Composite (GE)*	.77	.73	.76	.77	.48
Reading (GE)	.74	.72	.80	.79	.44
Language Arts (GE)	.72	.61	1.00	.68	.38
Math (GE)	.72	.68	.63	.70	.51
Composite (GSV)**	.77	.73	.77	.77	.49
Reading (GSV)	.73	.71	.69	.77	.44
Language Arts (GSV)	.72	.63	.95	.70	.37
Math (GSV)	.72	.68	.63	.70	.51

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* GE is defined as grade equivalent.

** GSV is defined as growth scale value.

Results: Predictive Validity Study with the Cooperative Primary Test

The descriptive characteristics of the kindergarten population (N = 117) who received the Cooperative Primary Math Test in the third grade are contained in Table 26. The population characteristics of this subsample differ in several respects in comparison to the total kindergarten population with a corresponding male difference of 54% in comparison to 64%. The majority of this predictive validity sample (64.1%) were in open space classrooms in kindergarten in comparison to 29% for the total kindergarten population in 1974. However, group performance on each of the diagnostic tests is essentially equal. The subjects in this predictive validity study did not receive the SCREEN General Readiness scores as their Figure Copying subtest was not hand scored, this being one of the subtests which make up the General Readiness scale.

The Pearson correlations for the WISC and the ITPA PLQ are identical (Math raw score, r = .36 and Math percentile, r = .39, Table 27). The VMI correlations with the Math subtests are .32 and .30, respectively. Correlations for the PIAT total score with the Cooperative Primary Test subtests are .43 and .45. Class placement, age, and sex do not significantly correlate with either of the Math criterion.

The results of the multiple regression analyses for SCREEN, the ITPA, and WISC-Verbal batteries with the Math subtests are presented in Table 28. The PIAT battery correlations are not presented due to computer error. The multiple R's for the SCREEN battery are .64 and .68 for each of the Math subtest scores. The multiple R's for the ITPA with the achievement test are .55 and .58, respectively. WISC-Verbal multiple R's

Table 26

Descriptive Characteristics of Sample for
Cooperative Primary Test
(Kindergarten Predictive Study--Third Grade)

Age (in months):		
Mean	74.70	
Median	74.32	
SD	3.43	
Sex:		(%)
Females	53	45.3
Males	64	54.7
Total	117	
Class Placement:		(%)
Regular	42	35.9
Open Space	75	64.1
Referral Category:		(%)
Teacher Referred	8	6.8
SCREEN Referred	37	31.6
Common Referral	18	15.4
Comparison Group	54	46.2
ITPA-Psycholinguistic Quotient:		
Mean	103.21	
SD	12.59	
Range	64.00	
PIAT-Total:		
Mean (scaled score)	98.54	
SD	10.62	
Range	66.00	
SCREEN-General Readiness:		
Mean (t score)	--	
SD	--	
Range	--	
WISC-Verbal (Pro-rated Total):		
Mean (scaled score)	50.14	
SD	10.73	
Range	49.00	

Table 27

Predictive Validity ($2\frac{1}{2}$ Years),
Pearson r Correlations (Key Variables) with the
Cooperative Primary Test**

	ITPA PLQ	PIAT Total	WISC-Verbal	Beery VMI	Class Placement	Age	Sex
Math (Raw Score)	.36*	.43*	.36*	.32*	.11	.19	.07
Math (Percentile)	.39*	.45*	.39*	.30*	.13	.18	.09

** Pearson r correlations for SCREEN General Readiness not calculated--all subjects in this sample did not receive the Figure Copying subtest.

Table 28

Predictive Validity (2½ Years), Multiple R Correlations with Cooperative Primary Test

	SCREEN (1974) (N = 117)	ITPA (N = 117)	WISC-Verbal (N = 117)
Math (Raw Score)	.64	.55	.49
Math (Percentile)	.68	.58	.51

are considerably lower than SCREEN's and slightly lower than the ITPA's (R = .49 and R = .51).

Results: Predictive Validity Study with the Iowa Test of Educational Development

The descriptive characteristics for the first grade sample (N = 82) who received the Iowa Test of Educational Development in fourth grade are contained in Table 29. The descriptive characteristics for this fourth grade sample are slightly different in several respects from the total first grade population of 1974, Table 2. In the predictive validity study sample there are 22% Teacher Referred subjects in comparison to 14% in the original study. The Comparison Group in the current study represents 35.4% of this sample in relation to 41.2% in the same group for the total first grade population. All the subjects in this fourth grade sample were in regular classrooms at the time they were in first grade.

The means of the ITPA, PIAT, and WISC in the predictive study sample are slightly above the total first grade population means, but not sufficiently high enough to make a clinical difference between the groups.

The Pearson correlations of the PIAT total score with the Iowa Test of Educational Development criterion (Table 30) are relatively high (mean r = .70). The average of the PLQ and SCREEN General Readiness score correlations with these achievement subtests are approximately equal (r = .44) and are all in the moderate range. The Pearson correlations for the WISC-Verbal total score and the VMI are relatively low,

Table 29

Descriptive Characteristics of Sample for
Iowa Test of Educational Development Level E/BL (Multilevel),
(First Grade Predictive Study--Fourth Grade)

Age (in months):		
Mean	86.50	
Median	86.72	
SD	3.60	

Sex:		(%)
Females	29	35.4
Males	53	64.6
Total	82	

Class Placement:		(%)
Regular	82	100
Open Space	--	

Referral Category:		(%)
Teacher Referred	18	22.0
SCREEN Referred	18	22.0
Common Referral	17	20.7
Comparison Group	29	35.4

ITPA-Psycholinguistic Quotient:	
Mean	105.09
SD	11.59
Range	55.00

PIAT-Total:	
Mean (scaled score)	104.40
SD	8.61
Range	44.00

SCREEN-General Readiness:	
Mean (t score)	49.01
SD	8.16
Range	41.00

WISC-Verbal (Pro-rated Total):	
Mean (scaled score)	55.05
SD	9.80
Range	50.00

Table 30

Predictive Validity (2½ Years), Pearson r Correlations (Key Variables) with the Iowa Test of Educational Development Level E/BL (Multilevel)**

	ITPA PLQ	PIAT Total	WISC-Verbal	Beery VMI	SCREEN General Readiness	Age	Sex
Composite	.44*	.80*	.34*	.35*	.51*	.16	.00
Comprehension	.53*	.70*	.29	.24	.33*	.24	.09
Vocabulary	.45*	.75*	.35*	.33*	.44*	.13	.00
Total Reading	.51*	.76*	.33*	.30*	.41*	.19	.05
Usage	.44*	.75*	.31*	.39*	.56*	.11	-.04
Spelling	.33*	.68*	.20	.30*	.39*	.13	-.02
Total Language Arts	.41*	.77*	.29	.38*	.53*	.13	-.04
Concepts	.46*	.70*	.33*	.27	.46*	.09	.06
Computation	.29	.61*	.17	.39*	.44*	.14	-.13
Total Math	.38*	.71*	.27	.34*	.49*	.12	-.03
Social Studies	.50*	.69*	.31*	.30*	.38*	.24	.09
Science	.51*	.61*	.15	.34*	.43*	.21	.07
Use of Sources	.50*	.66*	.31*	.35*	.44*	.26	-.02

** Pearson r correlations for class placement not calculated--all subjects in this sample were in regular classrooms in 1974.

averaging .28 and .33, respectively. Age and sex do not significantly correlate with any of the achievement subtests.

The multiple R correlations for the total batteries with the Iowa Test of Educational Development are contained in Table 31. The correlations for the total SCREEN battery, PIAT, and MAT are in relatively the same range, averaging .70 to .78, respectively. The ITPA correlations with the achievement subtests range from .52 to .67 (mean R = .61). The multiple R's for the WISC-Verbal scale are significantly lower than the other prediction measures ranging from .32 to .46 (mean R = .42).

Results: Predictive Validity Study with the Stanford Achievement Test

The descriptive characteristics for the subsample of first grade children (N = 50) who received the Stanford Achievement Test while in fourth grade are presented in Table 32. There are 44% females and 56% males in the current sample in comparison to 38% females and 62% males in the original first grade sample, Table 2. Subjects in this predictive validity study were all in regular classrooms while in first grade. In the original first grade sample, 31.2% were in the Comparison Group while 52% are in the same group for the current study. The ITPA Psycholinguistic Quotient (mean R = 108.14, SD = 13.62) of the fourth grade sample is slightly higher than the PLQ mean for the first grade sample (mean R = 103.88, SD = 12.56). All other population characteristics are essentially the same in comparison to the original first grade sample.

Within each predictor variable, there is considerable variability in Pearson correlations with the Stanford Achievement Test, Table 33.

Table 31

Predictive Validity (2½ Years),
Multiple R Correlations with Iowa Test of Educational Development Level E/BL (Multilevel)

	SCREEN (1974) (N = 82)	ITPA (N = 82)	PIAT (N = 82)	Metropolitan Achievement (N = 63)	WISC-Verbal (N = 82)
Composite	.74	.61	.82	.87	.46
Comprehension	.62	.64	.71	.73	.44
Vocabulary	.68	.60	.78	.75	.44
Total Reading	.67	.63	.79	.77	.45
Usage	.75	.58	.76	.80	.46
Spelling	.62	.56	.71	.81	.34
Total Language Arts	.75	.60	.79	.86	.44
Concepts	.65	.67	.73	.76	.45
Computation	.69	.52	.68	.80	.32
Total Math	.72	.61	.75	.83	.40
Social Studies	.71	.67	.72	.79	.45
Science	.68	.60	.65	.66	.34
Use of Sources	.74	.61	.69	.78	.46

Table 32

Descriptive Characteristics of Sample for
Stanford Achievement Test (1973 Edition, Primary 3A),
(First Grade Predictive Study--Fourth Grade)

Age (in months):		
Mean	87.30	
Median	86.93	
SD	3.86	
Sex:		(%)
Females	22	44.0
Males	28	56.0
Total	50	
Class Placement:		(%)
Regular	50	100
Open Space	--	
Referral Category:		(%)
Teacher Referred	5	10.0
SCREEN Referred	10	20.0
Common Referral	9	18.0
Comparison Group	26	52.0
ITPA-Psycholinguistic Quotient:		
Mean	108.14	
SD	13.62	
Range	64.00	
PIAT-Total:		
Mean (scaled score)	102.44	
SD	10.37	
Range	57.00	
SCREEN-General Readiness:		
Mean (_t_ score)	49.46	
SD	10.49	
Range	42.00	
WISC-Verbal (Pro-rated Total):		
Mean (scaled score)	54.76	
SD	11.15	
Range	49.00	

Table 33

Predictive Validity (2½ Years), Pearson *r* Correlations (Key Variables) with the Stanford Achievement Test (1973 Edition, Primary 3A)**

	ITPA PLQ	PIAT Total	WISC-Verbal	Beery VMI	SCREEN General Readiness	Age	Sex
Vocabulary	.69*	.72*	.52*	.35*	.53*	-.19	.35*
Reading Comprehension	.32*	.64*	.35*	.11	.28	-.11	-.22
Word Study Skills	.38*	.62*	.23	.21	.38*	-.18	-.16
Math Concepts	.54*	.64*	.43*	.36*	.54*	.00	.15
Math Comprehension	.32*	.44*	.27	.12	.46*	.01	-.13
Math Applications	.48*	.60*	.43*	.27	.55*	-.05	.00
Spelling	.09	.47*	.07	.16	.27	-.11	-.15
Social Science	.40*	.63*	.31*	.22	.37*	-.10	-.09
Science	.44*	.58*	.26	.21	.33*	-.11	-.07
Listening Comprehension	.64*	.57*	.30*	.17	.43*	-.04	-.05
Total Reading	.37*	.68*	.32*	.16	.35*	-.15	-.21
Total Math	.51*	.64*	.43*	.28	.59*	-.02	.00
Total Auditory	.74*	.72*	.45*	.29	.53*	-.12	.16
Complete Battery	.48*	.72*	.34*	.25	.47*	-.11	-.10
Language	.31*	.57*	.11	.23	.32*	-.03	-.20

** Pearson *r* correlations for class placement not calculated--all subjects in this sample were in regular classrooms in 1974.

The lowest correlations are obtained by the VMI and WISC-Verbal scales with an average of .23 and .35, respectively. The Pearson correlations for the SCREEN General Readiness score range from .27 to .59 (mean *r* = .43) with the Stanford Achievement subtests. The highest correlations for the General Readiness measure are with the Vocabulary subtest, Math Concepts, Math Applications, Total Math, and Total Auditory. The correlations for the PLQ range from .09 to .74 (mean *r* = .48) with the achievement criterion. The highest correlations for the ITPA total score are with the Vocabulary, Math Concepts, Listening Comprehension, Total Math, and Total Auditory subtests. In comparison to the other predictor variables, the correlations for the PIAT total score with the achievement subtests are relatively consistent (mean *r* = .62). The VMI and WISC-Verbal scale correlations are comparatively lower than the other predictor measures, mean *r* = .23 and mean *r* = .35, respectively. The age and sex variables do not significantly correlate with any of the Stanford Achievement subtests.

The multiple R correlations for the SCREEN battery, ITPA, PIAT, and MAT with the Stanford Achievement subtests are on the average equal with mean R's ranging from .69 to .72, Table 34. The multiple R's for the WISC-Verbal are considerably lower in comparison to other predictors (mean R = .44).

Results: Predictive Validity Study with the Cooperative Primary Test

The descriptive characteristics for the population of first grade children (*N* = 94) who received the Cooperative Primary Test in fourth

Table 34

Predictive Validity ($2\frac{1}{2}$ Years), Multiple R Correlations with Stanford Achievement Test (1973 Edition, Primary 3A)

	SCREEN (1974) (*N* = 50)	ITPA (*N* = 50)	PIAT (*N* = 50)	Metropolitan Achievement (*N* = 48)	WISC-Verbal (*N* = 50)
Vocabulary	.73	.79	.81	.64	.61
Reading Comprehension	.67	.68	.68	.74	.46
Word Study Skills	.62	.68	.65	.73	.44
Math Concepts	.82	.71	.71	.77	.48
Math Comprehension	.61	.66	.63	.67	.38
Math Applications	.70	.67	.67	.69	.45
Spelling	.57	.54	.69	.76	.33
Social Science	.75	.69	.63	.75	.44
Science	.78	.70	.61	.72	.37
Listening Comprehension	.73	.77	.63	.58	.44
Total Reading	.68	.71	.72	.79	.47
Total Math	.76	.73	.73	.80	.47
Total Auditory	.78	.86	.79	.66	.55
Complete Battery	.78	.74	.74	.85	.46
Language	.74	.67	.68	.74	.25

The lowest correlations are obtained by the VMI and WISC-Verbal scales with an average of .23 and .35, respectively. The Pearson correlations for the SCREEN General Readiness score range from .27 to .59 (mean r = .43) with the Stanford Achievement subtests. The highest correlations for the General Readiness measure are with the Vocabulary subtest, Math Concepts, Math Applications, Total Math, and Total Auditory. The correlations for the PLQ range from .09 to .74 (mean r = .48) with the achievement criterion. The highest correlations for the ITPA total score are with the Vocabulary, Math Concepts, Listening Comprehension, Total Math, and Total Auditory subtests. In comparison to the other predictor variables, the correlations for the PIAT total score with the achievement subtests are relatively consistent (mean r = .62). The VMI and WISC-Verbal scale correlations are comparatively lower than the other predictor measures, mean r = .23 and mean r = .35, respectively. The age and sex variables do not significantly correlate with any of the Stanford Achievement subtests.

The multiple R correlations for the SCREEN battery, ITPA, PIAT, and MAT with the Stanford Achievement subtests are on the average equal with mean R's ranging from .69 to .72, Table 34. The multiple R's for the WISC-Verbal are considerably lower in comparison to other predictors (mean R = .44).

Results: Predictive Validity Study with the Cooperative Primary Test

The descriptive characteristics for the population of first grade children (N = 94) who received the Cooperative Primary Test in fourth

Table 34

Predictive Validity (2½ Years),
Multiple R Correlations with Stanford Achievement Test (1973 Edition, Primary 3A)

	SCREEN (1974) (N = 50)	ITPA (N = 50)	PIAT (N = 50)	Metropolitan Achievement (N = 48)	WISC-Verbal (N = 50)
Vocabulary	.73	.79	.81	.64	.61
Reading Comprehension	.67	.68	.68	.74	.46
Word Study Skills	.62	.68	.65	.73	.44
Math Concepts	.82	.71	.71	.77	.48
Math Comprehension	.61	.66	.63	.67	.38
Math Applications	.70	.67	.67	.69	.45
Spelling	.57	.54	.69	.76	.33
Social Science	.75	.69	.63	.75	.44
Science	.78	.70	.61	.72	.37
Listening Comprehension	.73	.77	.63	.58	.44
Total Reading	.68	.71	.72	.79	.47
Total Math	.76	.73	.73	.80	.47
Total Auditory	.78	.86	.79	.66	.55
Complete Battery	.78	.74	.74	.85	.46
Language	.74	.67	.68	.74	.25

grade are contained in Table 35. The only difference in this subpopulation sample is that 36.2% of the subjects were in regular classrooms in comparison to 76.8% of the original first grade sample, and 63.8% are in open space classrooms in comparison to 23.2% in the original first grade sample, Table 2.

The subjects in this sample did not receive the SCREEN General Readiness score because the Figure Copying subtest was not hand scored in this district. In addition, this district did not administer the Metropolitan Achievement Test in the first grade.

The ITPA Pearson correlations range from .20 to .43 (mean r = .36), Table 36. PIAT total battery correlations range from .44 to .64 (mean r = .55). Pearson correlations for the WISC-Verbal score range from .08 to .32 (mean r = .29). The VMI correlations with the Cooperative Primary subtests are considerably lower than the other measures ranging from .15 to .35 (mean r = .22). Class Placement, age, and sex do not significantly correlate with any of the Cooperative Primary subtests.

The average multiple R's for the SCREEN battery (R = .64) and the PIAT battery (R = .61) are within the same ranges, Table 37. The ITPA multiple R's with the Cooperative Primary Test range from .37 to .54 (mean R = .49). In comparison, the WISC-Verbal scales are considerably lower ranging from .13 to .42 (mean R = .32).

Table 35

Descriptive Characteristics of Sample for Cooperative Primary Test (First Grade Predictive Study--Fourth Grade)

Age (in months):		
Mean	87.18	
Median	87.63	
SD	3.94	
Sex:		(%)
Females	38	40.4
Males	56	59.6
Total	94	
Class Placement:		(%)
Regular	34	36.2
Open Space	60	63.8
Referral Category:		(%)
Teacher Referred	11	11.7
SCREEN Referred	25	26.6
Common Referral	18	19.1
Comparison Group	40	42.6
ITPA-Psycholinguistic Quotient:		
Mean	101.35	
SD	11.38	
Range	55.00	
PIAT-Total:		
Mean (scaled score)	98.02	
SD	9.83	
Range	47.00	
SCREEN-General Readiness:		
Mean (t score)	--	
SD	--	
Range	--	
WISC-Verbal (Pro-rated Total):		
Mean (scaled score)	49.99	
SD	9.92	
Range	40.00	

Table 36

Predictive Validity (2½ Years), Pearson r Correlations (Key Variables) with the Cooperative Primary Test**

	ITPA PLQ	PIAT Total	WISC-Verbal	Beery VMI	Class Placement	Age	Sex
Listening (Raw Score)	.37*	.44*	.31*	.35*	.25	.18	.08
Word Analysis (Raw Score)	.20	.50*	.30*	.22	.22	.11	-.23
Math (Raw Score)	.39*	.50*	.30*	.24	.03	.07	-.14
Reading (Raw Score)	.35*	.63*	.28	.15	-.01	.02	-.28
Spelling (Raw Score)	.20	.48*	.08	.20	.19	.15	-.07
Punctuation (Raw Score)	.38*	.51*	.30*	.18	.13	.07	-.29
Total Writing (Raw Score)	.38*	.61*	.28	.23	.16	.06	-.24
Listening (Standard Score)	.41*	.44*	.32*	.32*	.20	.16	.08
Word Analysis (Standard Score)	.33*	.62*	.31*	.22	.17	.04	.20
Math (Standard Score)	.39*	.48*	.29	.20	.03	.06	-.14
Reading (Standard Score)	.38*	.63*	.32*	.19	.03	.05	-.27
Spelling (Standard Score)	.36*	.66*	.28	.19	.05	.02	-.12
Punctuation (Standard Score)	.42*	.52*	.32*	.17	.07	.02	-.24
Total Writing (Standard Score)	.43*	.64*	.32*	.19	.06	.01	-.20

** Pearson r correlations for SCREEN General Readiness not calculated--all subjects in this sample did not receive the Figure Copying subtest.

Table 37

Predictive Validity (2½ Years), Multiple R Correlations with Cooperative Primary Test

	SCREEN (1974) (N = 94)	ITPA (N = 94)	PIAT (N = 94)	WISC-Verbal (N = 93)
Listening (Raw Score)	.65	.49	.51	.40
Word Analysis (Raw Score)	.57	.44	.60	.31
Math (Raw Score)	.59	.54	.60	.32
Reading (Raw Score)	.71	.52	.69	.29
Spelling (Raw Score)	.56	.37	.57	.13
Punctuation (Raw Score)	.61	.46	.57	.32
Total Writing (Raw Score)	.70	.45	.67	.29
Listening (Standard Score)	.62	.51	.48	.42
Word Analysis (Standard Score)	.68	.52	.66	.36
Math (Standard Score)	.58	.53	.57	.29
Reading (Standard Score)	.72	.52	.69	.33
Spelling (Standard Score)	.67	.50	.72	.32
Punctuation (Standard Score)	.59	.51	.58	.34
Total Writing (Standard Score)	.65	.53	.68	.35

Results: Predictive Validity Study with the Teacher Follow-up Questionnaire (1977)

The descriptive characteristics for the kindergarten population subsample (N = 54) who received complete teacher ratings 2½ years after the original study are contained in Table 38. This sample differs from the original sample (Table 1) in that 22.2% are females in comparison to 35.6% females and 77.8% are males in comparison to 64.4% males. There has been a change in the class placement of the children over the 2½ year period. The original sample had 71.1% of the kindergarten population in regular classrooms and 29% in open space classrooms, Table 1. The current class placement of the Teacher Follow-up Questionnaire (1977) sample is distributed over four categories: regular (72.2%), open space (16.7%), special education--part time (7.4%), and special education--full time (3.7%). Of the 54 children in the current predictive study, 90.7% were in regular classrooms while in kindergarten and the remainder were in open space classrooms (9.3%). By the time these children were in the third grade, some had been placed in open space classrooms while others had been moved into special education placements. The total special education placement figure (11.1%) for the teacher follow-up sample is close to the national figure of approximately 12.5% who receive special education services under federal reimbursement categories. Seven of the subjects in the current study were Teacher Referred in 1974 (13%) in comparison to 8.2% of the original sample in Table 1. In addition, the SCREEN Referred percentage in this population is less (20.4%) in comparison to the original sample (27.1%). Performance on the diagnostic measures including the ITPA, PIAT, and WISC are relatively equal to the

Table 38

Descriptive Characteristics for Kindergarten Population with Teacher Follow-up Questionnaire (1977)

Age (in months):	
Mean	75.15
Median	74.25
SD	4.58
Range	21.00
Minimum	68.00
Maximum	89.00

Sex:		(%)
Females	12	22.2
Males	42	77.8
Total	54	

Ethnic Membership:		(%)
Caucasian	49	96.1
Spanish American	2	3.9
Missing Data	11	

Current Class Placement (1977):		(%)
Regular	39	72.2
Open Space	9	16.7
Special Education-Part Time	4	7.4
Special Education-Full Time	2	3.7

Class Placement (1974):		(%)
Regular	49	90.7
Open Space	5	9.3

Referral Category:		(%)
Teacher Referred	7	13.0
SCREEN Referred	11	20.4
Common Referral	8	14.8
Comparison Group	28	51.9

ITPA-Psycholinguistic Quotient (N = 54):	
Mean	108.69
SD	13.19
Range	65.00

PIAT-Total (N = 54):	
Mean (scaled score)	101.15
SD	9.72
Range	46.00

Table 38, Continued

Descriptive Characteristics for Kindergarten Population with Teacher Follow-up Questionnaire (1977)

SCREEN-General Readiness (N = 54):	
Mean (t score)	48.57
SD	9.42
Range	39.00

WISC-Verbal (Pro-rated Total, N = 54):	
Mean (scaled score)	52.26
SD	10.36
Range	47.00

Teacher Follow-up Questionnaire (1977)
Child's Current Performance in School Skills--

Word Reading:		(%)
Above Age Level	12	22.2
Slightly Above Age Level	8	14.8
At Age Level	10	18.5
Slightly Below Age Level	10	18.5
Below Age Level	14	25.9

Sentence Reading:		(%)
Above Age Level	12	22.2
Slightly Above Age Level	9	16.7
At Age Level	9	16.7
Slightly Below Age Level	11	20.4
Below Age Level	13	24.1

Reading Comprehension:		(%)
Above Age Level	10	18.5
Slightly Above Age Level	7	13.0
At Age Level	14	25.9
Slightly Below Age Level	12	22.2
Below Age Level	11	20.4

Spelling:		(%)
Above Age Level	10	18.5
Slightly Above Age Level	10	18.5
At Age Level	15	27.8
Slightly Below Age Level	9	16.7
Below Age Level	10	18.5

Table 38, Continued

Descriptive Characteristics for Kindergarten Population with Teacher Follow-up Questionnaire (1977)

Receptive Language:		(%)
Above Age Level	11	20.4
Slightly Above Age Level	8	14.8
At Age Level	26	48.1
Slightly Below Age Level	5	9.3
Below Age Level	4	7.4
Expressive Language:		(%)
Above Age Level	13	24.1
Slightly Above Age Level	8	14.8
At Age Level	20	37.0
Slightly Below Age Level	11	20.4
Below Age Level	2	3.7
Math Computation:		(%)
Above Age Level	10	18.5
Slightly Above Age Level	14	25.9
At Age Level	19	35.2
Slightly Below Age Level	8	14.8
Below Age Level	3	5.6
Math Concepts/Reasoning:		(%)
Above Age Level	9	16.7
Slightly Above Age Level	14	25.9
At Age Level	18	33.3
Slightly Below Age Level	9	16.7
Below Age Level	4	7.4
Social Science:		(%)
Above Age Level	7	13.0
Slightly Above Age Level	8	14.8
At Age Level	29	53.7
Slightly Below Age Level	9	16.7
Below Age Level	1	1.9
Science:		(%)
Above Age Level	6	11.1
Slightly Above Age Level	8	14.8
At Age Level	30	55.6
Slightly Below Age Level	9	16.7
Below Age Level	1	1.9

Table 38, Continued

Descriptive Characteristics for Kindergarten Population with Teacher Follow-up Questionnaire (1977)

General Descriptive Information--		
Received Special Education Diagnostic Services:		(%)
Don't Know	7	13.0
No	28	51.9
Yes	19	35.2
Received Special Education Teaching Services:		(%)
Don't Know	3	5.6
No	36	66.7
Yes	15	27.8
Grades Repeated:		(%)
Don't Know	3	5.6
No	42	77.8
Yes	9	16.7
Should Be Referred for Psychological and/or Educational Testing:		(%)
Don't Know	1	1.9
No	46	85.2
Yes	7	13.0
Vision Problem Present:		(%)
Don't Know	--	
No	48	88.9
Yes	6	11.1
Hearing Problem Present:		(%)
Don't Know	1	1.9
No	51	94.4
Yes	2	3.7
Articulation Problem Present:		(%)
Don't Know	--	
No	50	92.6
Yes	4	7.4
Physical Handicap Present:		(%)
Don't Know	--	
No	52	96.3
Yes	2	3.7

Table 38, Continued

Descriptive Characteristics for Kindergarten Population with Teacher Follow-up Questionnaire (1977)

Bilingual:		(%)
Don't Know	2	3.7
No	51	94.4
Yes	1	1.9
Cultural Background Causes Communication Difficulties in Classroom:		(%)
Don't Know	--	
No	54	100
Yes	--	

original kindergarten population. Teacher follow-up ratings of the child's performance in third grade in various school skills are also contained in Table 38. Teacher ratings of school skills reflect a tendency to rate students on a normally distributed scale.

The Teacher Follow-up Questionnaire (1977) also included questions on general descriptive information, Table 38. It is interesting to note that 35.2% of the current population received special education diagnostic services. This latter figure is very close to the relative percentage of third grade children (27.8%) who received special education teaching services since being in kindergarten. Since kindergarten, 16.7% of the current sample (N = 54) have repeated at least one grade and the teachers requested that seven of the 54 (13%) should be referred for psychological and/or educational testing. Teachers rated 11.1% of the children as having vision problems in the third grade. The teacher ratings of "hearing problems present" in the current sample (3.7%) is more reflective of the figure (1.9%) in the original sample, Table 1. Teachers rated 7.4% of this sample as having articulation problems and 3.7% of the sample as having some physical handicap present. Although teachers rated 1.9% of the children as being bilingual, none of the children are rated as having communication difficulties in the classroom related to a cultural background.

Teacher ratings of school skills which were utilized as criterion variables in the current study are listed with associated variable numbers for the correlation tables in Table 39. The SCREEN, PIAT, VMI, ITPA, WISC, and Phonetics subtests correlations with the Teacher

Table 39

Variable List for Teacher Follow-up Questionnaire (1977) Tables

Variable Number	Variable Name
	Teacher Follow-up Questionnaire (1977)
	Child's Current Performance in School Skills:
1	Word Reading
2	Sentence Reading
3	Reading Comprehension
4	Spelling
5	Receptive Language
6	Expressive Language
7	Math Computation
8	Math Concepts/Reasoning
9	Social Science
10	Science

Follow-up Questionnaire ratings of school skills are presented in Table 40. The Figure Copying subtest and Basic Knowledge and General Readiness subtest of SCREEN have moderate significant correlations with the first six teacher ratings of language skills, word reading through expressive language. The SCREEN teacher ratings of Cognitive-Perceptual Skills have significant correlations with all the teacher follow-up ratings of school skills ranging from .38 to .57. None of the other SCREEN teacher ratings scales are significantly correlated with teacher ratings 2½ years later.

With the exception of Reading Comprehension, the other PIAT scales generally produce significant moderate correlations with the teacher ratings of language skills, word reading through expressive language. Teacher ratings 7-10, math and science skills, are significantly related ($r = .38$ to $r = .47$) to the PIAT Math subtest.

Only the Auditory Association, Grammatic Closure, Auditory Closure, Sound Blending, and Psycholinguistic Quotient of the ITPA have significant correlations in the low to moderate range with various teacher ratings of school skills. The majority of the significant correlations fall on the first six language related teacher follow-up ratings.

The majority of significant correlations between the WISC scales are with teacher ratings of receptive language and expressive language. In the kindergarten sample, the Phonetics measures range from .35 to .74, with the first six teacher ratings of language skills. The significant Phonetics Test correlations with the math and science teacher ratings are all in the moderate range.

Table 40

Teacher Follow-up Questionnaire (1977) r Correlations with SCREEN, the PIAT, VMI, ITPA, WISC-Verbal, and Phonetics Test (Kindergarten Predictive Study--Third Grade)

	1	2	3	4	5	6	7	8	9	10
SCREEN										
Self Concept and School Adjustment	-.02	-.01	.09	.05	.15	.12	-.04	-.01	.11	.11
Visual Skills	.24	.22	.22	.16	.21	.23	.10	.26	.18	.16
Auditory Skills	.11	.12	.14	.05	.26	.22	-.02	.12	.29	.26
Figure Copying (Hand Scored)	.28	.28	.33*	.35*	.48*	.38*	.28	.27	.38*	.35*
Basic Knowledge	.33*	.35*	.40*	.26	.35*	.30*	.20	.28	.26	.23
General Readiness	.33*	.33*	.37*	.31*	.49*	.42*	.21	.31*	.42*	.37*
Teacher Ratings of Cognitive-Perceptual Skills	.38*	.38*	.40*	.57*	.46*	.45*	.35*	.39*	.42*	.40*
Teacher Ratings of Behavioral Adjustment	-.08	-.07	.00	.13	.24	.16	.08	.06	.15	.12
Teacher Ratings of Social Adjustment	-.07	-.06	-.03	.22	.05	.10	.09	.08	.09	.06
Teacher Ratings of Immaturity	-.06	-.05	.04	.16	.14	.09	.12	.10	.10	.07
Total Teacher Ratings	.10	.11	.17	.39*	.33*	.30*	.23	.23	.28	.24
Optical Scan Figure Copying	.29	.28	.25	.28	.43*	.34	.22	.28	.29	.25
PIAT										
Math	.42*	.41*	.40*	.31*	.48*	.56*	.41*	.47*	.41*	.38*
Reading Recognition	.43*	.41*	.36*	.32*	.30*	.37*	.14	.18	.18	.22
Reading Comprehension	.04	.04	.10	.07	-.10	-.10	-.28	-.35*	-.05	.02
Spelling	.39*	.37*	.36*	.27	.38*	.37*	.14	.21	.28	.30*
General Information	.43*	.42*	.43*	.31*	.36*	.49*	.28	.38*	.32*	.35*
Total	.53*	.50*	.48*	.41*	.43*	.53*	.29	.35*	.36*	.38*

Table 40, Continued

	1	2	3	4	5	6	7	8	9	10
VMI	.37*	.39*	.46*	.39*	.44*	.38*	.35*	.40*	.45*	.43*
ITPA										
Auditory Association	.35*	.33*	.29	.23	.29	.48*	.31*	.36*	.27	.23
Auditory Sequential Memory	.17	.20	.16	.25	.35*	.33*	.03	.04	.12	.13
Auditory Reception	.16	.14	.11	-.05	-.03	.02	-.19	-.09	-.14	-.15
Visual Reception	.14	.12	.04	-.05	.15	.23	-.06	.05	.07	.14
Visual Sequential Memory	.15	.19	.16	.19	.15	.16	.29	.30*	.08	.02
Visual Association	.20	.19	.15	.22	.36*	.37*	.09	.13	.23	.24
Visual Closure	-.04	-.04	-.01	.05	.08	.11	-.06	-.03	.03	.03
Verbal Expression	.18	.18	.10	.08	.16	.17	.12	.20	.08	.08
Grammatic Closure	.40*	.40*	.39*	.20	.29	.28	.11	.21	.18	.18
Manual Expression	.14	.13	.10	.16	.26	.18	-.06	.06	.18	.22
Auditory Closure	.31*	.29	.30*	.16	.09	.07	.03	.08	.10	.08
Sound Blending	.32*	.31*	.33*	.18	.28	.31*	.09	.21	.04	.02
Psycholinguistic Quotient	.36*	.36*	.32*	.19	.36*	.39*	.08	.20	.17	.15
WISC-Verbal										
Comprehension	-.14	-.13	-.18	-.11	.00	.01	-.18	-.10	-.15	-.15
Similarities	.30*	.27	.29	.12	.17	.30*	.19	.20	.05	.05
Vocabulary	.18	.17	.15	.20	.31*	.27	.11	.13	.18	.22
Digit Span	.27	.28	.34*	.29	.40*	.45*	.21	.28	.29	.31*
Verbal IQ	.23	.22	.23	.18	.32*	.37*	.11	.16	.13	.15
Phonetics Test (Experimental)										
Initial Consonants	.60*	.59*	.57*	.57*	.57*	.61*	.42*	.52*	.47*	.46*
Long & Short Vowels	.49*	.47*	.46*	.35*	.42*	.40*	.36*	.42*	.28	.26
Final Consonants	.67*	.68*	.74*	.58*	.60*	.57*	.43*	.51*	.44*	.41*
Consonant Blends	.67*	.67*	.68*	.48*	.58*	.52*	.38*	.46*	.45*	.42*
Total	.71*	.70*	.72*	.57*	.62*	.60*	.44*	.54*	.46*	.43*

The descriptive characteristics for the first grade population (N = 56) with complete Teacher Follow-up Questionnaire (1977) ratings are presented in Table 41. The age and sex distributions are relatively comparable to the descriptive characteristics of the original total first grade population, Table 2. In 1974, 96.4% of the current sample were in regular classrooms in comparison to 76.8% of the original first grade population. There has been considerable movement to other class placements in the years between first and fourth grade for this sample with 14.5% currently in open space settings, 10.9% in part-time special education placement, and 5.5% in full-time special education placement. The total figure of special education placement (16.4%) for this fourth grade subpopulation is higher than the total receiving special education services in the third grade subpopulation (11.1%). There are slight differences in the relative percentage of fourth grade children in comparison to the original first grade population in each of the referral categories: Teacher Referred (10.7%, 14.4%), SCREEN Referred (21.4%, 22.2%), Common Referral (17.9%, 22.2%), and Comparison Group (50.0%, 41.2%). Performance on the diagnostic tests including the ITPA, PIAT, and WISC are relatively comparable to the original total first grade sample. The scales for the teacher ratings of school skills tend to be relatively normally distributed, Table 41.

In the current teacher follow-up sample, 25% of the fourth grade children have received special education diagnostic services since the first grade and a corresponding 26.8% have received special education teaching services some time between first grade and the fourth grade.

Table 41

Descriptive Characteristics for First Grade Population with Teacher Follow-up Questionnaire (1977)

Age (in months):	
Mean	87.86
Median	86.79
SD	5.49
Range	30.00
Minimum	80.00
Maximum	110.00

Sex:		(%)
Females	23	41.1
Males	33	58.9
Total	56	

Ethnic Membership:		(%)
Caucasian	52	92.9
Spanish American	2	3.6
Oriental	2	3.6
Missing Data	--	

Current Class Placement (1977):		(%)
Regular	38	69.1
Open Space	8	14.5
Special Education-Part Time	6	10.9
Special Education-Full Time	3	5.5
Missing Data	1	

Class Placement (1974):		(%)
Regular	54	96.4
Open Space	2	3.6

Referral Category:		(%)
Teacher Referred	6	10.7
SCREEN Referred	12	21.4
Common Referral	10	17.9
Comparison Group	28	50.0

ITPA-Psycholinguistic Quotient (*N* = 56):	
Mean	106.23
SD	13.15
Range	62.00

PIAT-Total (*N* = 56):	
Mean (scaled score)	101.96
SD	13.07
Range	62.00

Table 41, Continued

Descriptive Characteristics for First Grade Population with Teacher Follow-up Questionnaire (1977)

SCREEN-General Readiness (N = 56):	
Mean (t score)	49.14
SD	11.02
Range	49.00

WISC-Verbal (Pro-rated Total, N = 56):	
Mean (scaled score)	52.76
SD	11.67
Range	49.00

Teacher Follow-up Questionnaire (1977)
Child's Current Performance in School Skills--

Word Reading:		(%)
Above Age Level	8	14.3
Slightly Above Age Level	9	16.1
At Age Level	16	28.6
Slightly Below Age Level	12	21.4
Below Age Level	11	19.6

Sentence Reading:		(%)
Above Age Level	9	16.1
Slightly Above Age Level	6	10.7
At Age Level	22	39.3
Slightly Below Age Level	10	17.9
Below Age Level	9	16.1

Reading Comprehension:		(%)
Above Age Level	9	16.1
Slightly Above Age Level	7	12.5
At Age Level	15	26.8
Slightly Below Age Level	16	28.6
Below Age Level	9	16.1

Spelling:		(%)
Above Age Level	9	16.1
Slightly Above Age Level	10	17.9
At Age Level	19	33.9
Slightly Below Age Level	9	16.1
Below Age Level	9	16.1

Table 41, Continued

Descriptive Characteristics for First Grade Population
with Teacher Follow-up Questionnaire (1977)

Receptive Language:		(%)
Above Age Level	10	17.9
Slightly Above Age Level	5	8.9
At Age Level	28	50.0
Slightly Below Age Level	6	10.7
Below Age Level	7	12.5
Expressive Language:		(%)
Above Age Level	8	14.3
Slightly Above Age Level	10	17.9
At Age Level	25	44.6
Slightly Below Age Level	8	14.3
Below Age Level	5	8.9
Math Computation:		(%)
Above Age Level	9	16.1
Slightly Above Age Level	8	14.3
At Age Level	20	35.7
Slightly Below Age Level	12	21.4
Below Age Level	7	12.5
Math Concepts/Reasoning:		(%)
Above Age Level	7	12.5
Slightly Above Age Level	10	17.9
At Age Level	17	30.4
Slightly Below Age Level	10	17.9
Below Age Level	12	21.4
Social Science:		(%)
Above Age Level	6	10.7
Slightly Above Age Level	7	12.5
At Age Level	30	53.6
Slightly Below Age Level	8	14.3
Below Age Level	5	8.9
Science:		(%)
Above Age Level	7	12.5
Slightly Above Age Level	7	12.5
At Age Level	29	51.8
Slightly Below Age Level	9	16.1
Below Age Level	4	7.1

Table 41, Continued

Descriptive Characteristics for First Grade Population with Teacher Follow-up Questionnaire (1977)

General Descriptive Information--		
Received Special Education Diagnostic Services:		(%)
Don't Know	11	19.6
No	31	55.4
Yes	14	25.0
Received Special Education Teaching Services:		(%)
Don't Know	2	3.6
No	39	69.6
Yes	15	26.8
Grades Repeated:		(%)
Don't Know	--	
No	50	89.3
Yes	6	10.7
Should Be Referred for Psychological and/or Educational Testing:		(%)
Don't Know	--	
No	52	92.9
Yes	4	7.1
Vision Problem Present:		(%)
Don't Know	1	1.8
No	46	82.1
Yes	9	16.1
Hearing Problem Present:		(%)
Don't Know	1	1.8
No	54	96.4
Yes	1	1.8
Articulation Problem Present:		(%)
Don't Know	2	3.6
No	48	85.7
Yes	6	10.7
Physical Handicap Present:		(%)
Don't Know	--	
No	55	98.2
Yes	1	1.8

Table 41, Continued

Descriptive Characteristics for First Grade Population with Teacher Follow-up Questionnaire (1977)

Bilingual:		(%)
Don't Know	2	3.6
No	54	96.4
Yes	--	
Cultural Background Causes Communication Difficulties in Classroom:		(%)
Don't Know	--	
No	56	100
Yes	--	

This discrepancy may be due to a teacher rating error as it is doubtful that a child was placed in special education teaching services without first receiving some type of diagnostic service in either of these two districts. Since the first grade, 10.7% of this sample have repeated a grade and teachers state that 7.1% should receive psychological and/or educational testing. Teachers have rated 16.1% of the children as having a vision problem, including those children with corrected vision. Teachers rate only 1.8% of the children in the current study as having hearing problems in comparison to 3.3% of the total original first grade population. Only 1.8% of the children were rated as having some type of physical handicap present. Teachers stated that none of the current population were bilingual, subsequently none were rated as having communication difficulties in the classroom due to cultural backgrounds.

Correlations for the SCREEN test, VMI, ITPA, WISC, and Phonetics Test with the Teacher Follow-up Questionnaire (1977) ratings of school skills are in Table 42. In general, the Figure Copying, Basic Knowledge, and General Readiness subtests of SCREEN have low to moderate significant correlations with all ten teacher ratings of school skills. The SCREEN teacher ratings of Cognitive-Perceptual Skills have higher correlations ranging from .48 through .63 with the teacher follow-up ratings.

All the PIAT subtests produce moderate to above average correlations with all ten of the teacher ratings of school skills. In general, the VMI does not produce significant correlations with any of the teacher rating follow-up questions in either grade. Seven of the ITPA subscales produce moderate significant correlations with the ten teacher

Table 42

Teacher Follow-up Questionnaire (1977) r Correlations with SCREEN, the PIAT, VMI, ITPA, WISC-Verbal, and Phonetics Test (First Grade Predictive Study--Fourth Grade)

	1	2	3	4	5	6	7	8	9	10
SCREEN										
Self Concept and School Adjustment	.16	.10	.10	.23	.04	.11	.09	.07	.27	.14
Visual Skills	.26	.27	.26	.35*	.38*	.30*	.32*	.37*	.36*	.36*
Auditory Skills	.36*	.42*	.46*	.38*	.49*	.43*	.42*	.40*	.31*	.27
Figure Copying (Hand Scored)	.41*	.42*	.35*	.41*	.37*	.34*	.43*	.47*	.40*	.42*
Basic Knowledge	.26	.32*	.33*	.23	.47*	.35*	.37*	.43*	.33*	.34*
General Readiness	.46*	.50*	.46*	.48*	.53*	.45*	.52*	.57*	.48*	.49*
Teacher Ratings of Cognitive-Perceptual Skills	.48*	.56*	.57*	.63*	.62*	.50*	.56*	.55*	.46*	.48*
Teacher Ratings of Behavioral Adjustment	.01	.03	.03	.06	.18	.12	.04	-.02	.08	.09
Teacher Ratings of Social Adjustment	.30*	.31*	.29	.22	.32*	.37*	.37*	.42*	.29	.33*
Teacher Ratings of Immaturity	.15	.15	.14	.08	.28	.26	.17	.22	.18	.18
Total Teacher Ratings	.30*	.33*	.33*	.33*	.46*	.40*	.36*	.36*	.33*	.34*
Optical Scan Figure Copying	.31*	.33*	.27	.33*	.32*	.21	.35*	.35*	.36*	.38*
PIAT										
Math	.45*	.48*	.42*	.45*	.50*	.48*	.54*	.55*	.48*	.52*
Reading Recognition	.54*	.60*	.60*	.69*	.51*	.44*	.57*	.54*	.49*	.51*
Reading Comprehension	.55*	.60*	.57*	.66*	.61*	.53*	.61*	.55*	.58*	.58*
Spelling	.56*	.60*	.56*	.64*	.56*	.51*	.54*	.51*	.49*	.53*
General Information	.41*	.49*	.32*	.40*	.51*	.52*	.47*	.49*	.53*	.57*
Total	.57*	.62*	.57*	.64*	.62*	.55*	.61*	.60*	.57*	.61*

Table 42, Continued

	1	2	3	4	5	6	7	8	9	10
VMI	.30*	.24	.21	.25	.22	.33*	.29	.28	.18	.14
ITPA										
Auditory Association	.37*	.34*	.28	.40*	.38*	.36*	.47*	.44*	.43*	.38*
Auditory Sequential Memory	.38*	.39*	.39*	.44*	.37*	.30*	.46*	.44*	.40*	.46*
Auditory Reception	.24	.25	.25	.20	.19	.42*	.36*	.41*	.32*	.31*
Visual Reception	.24	.29	.21	.12	.26	.34*	.19	.19	.35*	.35*
Visual Sequential Memory	.07	.07	.06	.19	.22	.22	.24	.21	.10	.19
Visual Association	.47*	.47*	.46*	.44*	.41*	.40*	.58*	.57*	.47*	.47*
Visual Closure	.20	.17	.10	.17	.31*	.31*	.33*	.33*	.20	.21
Verbal Expression	.09	.09	.06	.13	.05	.03	.12	.08	.04	.00
Grammatic Closure	.36*	.44*	.36*	.49*	.46*	.42*	.39*	.40*	.43*	.39*
Manual Expression	.00	.04	.01	.01	.09	.06	.01	.04	.09	.04
Auditory Closure	.39*	.47*	.53*	.46*	.52*	.59*	.39*	.36*	.45*	.44*
Sound Blending	.48*	.45*	.38*	.40*	.34*	.33*	.44*	.41*	.37*	.39*
Psycholinguistic Quotient	.41*	.44*	.38*	.47*	.48*	.46*	.54*	.53*	.50*	.49*
WISC-Verbal										
Comprehension	.24	.14	.03	.06	.04	.12	.17	.12	.18	.19
Similarities	.29	.25	.27	.33*	.26	.36*	.41*	.39*	.30*	.33*
Vocabulary	.25	.27	.16	.26	.36*	.19	.25	.26	.25	.25
Digit Span	.43*	.49*	.46*	.50*	.37*	.34*	.51*	.50*	.45*	.48*
Verbal IQ	.42*	.38*	.30*	.37*	.35*	.32*	.44*	.43*	.39*	.41*
Phonetics Test (Experimental)										
Initial Consonants	.30*	.33*	.30*	.34*	.20	.16	.22	.23	.06	.12
Long & Short Vowels	.45*	.49*	.53*	.58*	.30*	.33*	.52*	.48*	.34*	.31*
Final Consonants	.33*	.31*	.29	.38*	.24	.22	.32*	.23	.16	.16
Consonant Blends	.52*	.55*	.56*	.59*	.47*	.37*	.48*	.43*	.38*	.35*
Total	.49*	.52*	.52*	.58*	.37*	.34*	.48*	.43*	.30*	.30*

ratings of school skills including Auditory Association, Auditory Sequential Memory, Visual Association, Grammatic Closure, Auditory Closure, Sound Blending, and the Psycholinguistic Quotient. Within the WISC-Verbal scales, the Similarities, Digit Span, and Verbal IQ scales produce significant low to moderate correlations across the ten teacher rating scales. Correlations between the Phonetics subtests are lower in comparison to those that were obtained in the kindergarten sample with the teacher rating follow-up scales. In general, the significant Phonetics subtest correlations are low to moderate with the teacher rating scales in the first grade sample.

Discussion: Predictive Validity Study with Achievement Tests

The results of this study indicate that the predictive validity of the group administered SCREEN procedure, over a 2½ year period, with five different achievement measures across two grades compares favorably with that of both individually administered diagnostic tests and other group readiness and achievement measures in most cases. The average multiple correlation of .70 for the SCREEN test battery with five different achievement tests in third and fourth grade containing 47 subtest variables is not significantly different from the PIAT as a predictor across 46 variables (average R = .70), the MRT across four variables (average R = .74), and the MAT across 28 achievement subtest variables (average R = .76). The average multiple correlation for the SCREEN battery in predicting group achievement measures in third and fourth grade is substantially above that which was obtained for the WISC-Verbal battery (average R = .43), and slightly above the average correlation for the total ITPA battery (R = .62). The predictive differences that occurred between the SCREEN battery and the individually administered diagnostic measures or achievement measures as predictors can be accounted for by the following facts:

1. The psychometric design of the SCREEN battery necessarily reduces the magnitude of statistical relationships between SCREEN and other tests which measure the whole range of functioning.
2. Similarity of item content increases the magnitude of the statistical relationship between predictor and criterion variables.

When one considers that the SCREEN battery was designed to predict across a wide range of school skills including self concept and various teacher ratings of behavior and social adjustment, it is surprising that the predictive validity of the screening battery is not significantly different from the individually administered achievement tests or the other group achievement measures. Both the PIAT battery and the Metropolitan series as predictors have subtests with item content which is very similar to the various achievement criterion measures. Therefore, the differences in correlation between SCREEN and the other predictor variables may well be accounted for by the similarities and differences in item content across predictor criterion measures. Evidence for the substantial predictive validity of the group administered SCREEN battery is also demonstrated when one compares the average multiple correlations of the predictors in this study with the composite achievement scores in third and fourth grade. The average multiple correlation for the predictor variables with the three composite achievement measures in this study are: SCREEN (average R = .76), ITPA (average R = .69), PIAT (average R = .77), WISC (average R = .47), MRT correlation with one composite achievement measure in third grade (average R = .77), and MAT correlation with two composite achievement measures in fourth grade (average R = .86). SCREEN, the ITPA, PIAT, and MRT batteries account for approximately the same amount of variance (48% to 59%) in predicting composite achievement scores over a 2½ year period. The concurrent validity study with the SCREEN norm sample produced an average multiple correlation of .73 across 191 achievement subtest variables (cf., Summary of SCREEN Reliability and Validity Data, Appendix A). This latter result is comparable to the average predictive correlation coefficient (R = .70) over a 2½ year period with 47 achievement subtest criterion variables. The average multiple correlation for the SCREEN battery with the composite achievement scores in the present predictive validity study was .76 in comparison to .84, the average concurrent validity multiple correlation with 19 total achievement test scores (cf., Summary of SCREEN Reliability and Validity Data, Appendix A). Thus, the predictive validity of the SCREEN battery with group administered achievement procedures is not substantially different from its concurrent validity coefficients in most cases. The predictive validity coefficients that were obtained with the SCREEN battery are substantial given that one can expect significant decreases in correlations over a 2½ year period.

The average Pearson correlation of the PIAT total score with the achievement criterion measures in this study (r = .59) is substantially higher than the average Pearson r for SCREEN (r = .47) and the ITPA (r = .44) batteries. However, these differences are more than likely associated with the high similarity in item content between the various PIAT subtests and the achievement criterion measures. In general, the total scores associated with the SCREEN, ITPA, and PIAT batteries have moderate simple correlations with the achievement subtests over a 2½ year period. In comparison, the average WISC Pearson correlations (r = .33) and the average correlation for the VMI (r = .28) are substantially below the other predictor measures. In addition, the multiple correlations for both of these measures in predicting group administered achievement tests over a 2½ year period are quite low. Evidence from this predictive validity study in conjunction with the previous concurrent validity study indicates that neither the WISC nor the VMI are substantial predictors of group administered achievement tests. Therefore, there seems to be little efficacy for utilizing the WISC or the VMI as a differential diagnostic indicator of potential school success across the general school population. In particular, it is questionable as to whether the WISC should continue to be utilized as a routine assessment instrument when a child is referred to the school psychologist because of variously related school problems. Parenthetically, the utilization of various intelligence measures has become institutionalized rather than based upon sound empirical evidence. However, previous studies with the WISC have indicated that it may have some utility with "highly select populations." Differences in correlations which have been obtained in previous studies with the WISC and achievement measures may be related to differences associated with the characteristics of the various subpopulations. In general, it may be safe to say that the WISC relates to scores on certain types of achievement measures for certain groups of children (Littell, 1960).

Evidence from the current study indicates that the ITPA is a moderate predictor of group achievement measures over a 2½ year period. The average multiple correlation (R = .62) for the ITPA across 47 achievement subtests is less than that obtained for the SCREEN battery, the PIAT, and the Metropolitan series. The ITPA average multiple correlation (R = .69) with the composite achievement measures over the same period is within the same range as the other predictor measures in this study. There are two probable reasons for the predictive differences which occurred between the ITPA and other predictor measures. First, the SCREEN battery is group administered, whereas the ITPA is individually administered. As such, the screening battery can be expected to relate more highly to group administered criterion measures in comparison to the ITPA correlational relationship. Second, the relationship of predictor to criterion measures can be expected to relate more highly when there is a similarity in item content. The individually and group administered achievement predictor variables in this study have very similar item content in relation to the criterion measures of group achievement. In comparison, the ITPA was not specifically designed to assess achievement across a wide range but rather to measure the underlying psycholinguistic processes which may be related to various language functions (e.g., auditory, visual, expression). Thus, when the design of the ITPA is considered in conjunction with the method of administration, the predictive validity coefficients over a 2½ year period with group administered achievement tests are adequate in most cases. The design of the ITPA is such that it cannot be expected to correlate highly over the wide range of variance associated with each of the achievement subpopulations in this study. If there is validity to the underlying ITPA processes, it can best be assessed by isolating relatively homogeneous ITPA performance subpopulations and determine whether or not these groupings are differentially related to achievement or other diagnostic criteria. The correlational techniques which are the basis for concurrent and predictive validity studies allows one to determine the degree of relationship between predictor and criterion measures across the general population being examined but does little in isolating the correlates to low frequency performance deficits. In all probability, it is these low frequency events which may be of diagnostic interest in special education and psychology, but their associations to criterion measures are lost to error variance across the wide range of skills in the general population. This specific empirical question will be addressed in the following cluster analytic study.

Discussion: Predictive Validity Study with the Teacher Follow-up Questionnaire (1977)

Comparison of the diagnostic and screening data from the total kindergarten and first grade population to the data for their respective subsamples who received complete teacher ratings 2½ years after the original study indicates that they are relatively similar samples. The only differences that occur are in the relative percentage of children who moved from regular class placements to open space and special education placements. This shift cannot be said to reflect any inherent bias in the subsamples but rather to represent routine school practices. In the fourth grade population, there is a relatively smaller percentage of Teacher Referred, and Teacher Referred plus SCREEN Referred children in comparison to the original first grade sample. Subsequently, the fourth grade subsample is made up of 50% "normal" children in comparison to the original sample of 41.2% in the respective Comparison Group. The third grade population consists of a greater percentage of Teacher Referred children and fewer SCREEN Refe[illegible] in comparison to the original kindergarten population. However, the [illegible]ive percentage of "normal" children remains consistent in comparison to the original kindergarten population. The relative percentage of children in each of the referral categories is approximately equal when one compares the third grade subpopulation and fourth grade subpopulation who are the subjects of the current study. In essence, the correlational differences that are obtained within the third grade subpopulation in comparison to the fourth grade subpopulation are not likely to reflect inherent differences in population characteristics.

Within the third grade population, Figure Copying, Basic Knowledge, General Readiness and teacher ratings of Cognitive-Perceptual Skills (SCREEN subtests) correlate significantly with the teacher ratings of school skills over a 2½ year period, Table 40. Within the fourth grade population, the Auditory Skills subtest of SCREEN also significantly correlates with the teacher ratings in addition to the same subtests which were significantly related in the third grade population, Table 42. It is interesting to note that the ten item teacher rating scale of SCREEN correlates as well as or higher than the total PIAT battery with teacher ratings of school skills over the 2½ year period. All of the PIAT subskills produced significant moderate correlations with the teacher ratings with the exception of one scale, Reading Comprehension in the third grade. The implication of this pattern of correlations is that if one wishes to predict teacher ratings over a period of time, the utilization of an expensive diagnostic battery would not be warranted. Teacher ratings of Cognitive-Perceptual Skills correlate as well as or higher than a more expensive individual assessment of achievement skills. This does not imply that teacher ratings should be utilized as a primary predictor of school success, as the previous studies have indicated that reliance on a teacher referral rating system alone produces many mistakes. Teachers tend to over-estimate the school related skills of children who are quiet, cooperative, socially skillful, and mature for their age. They are most likely to underestimate the intellectual skills of children who present behavioral problems, are immature, or have poor social skills.

More of the ITPA subtests in the first grade population produced significant correlations with the follow-up teacher ratings of school skills in the fourth grade in comparison to the number of ITPA subtests in the kindergarten population which produced significant correlations in the third grade. A similar increase in correlations with the teacher ratings occurs in the WISC-Verbal scales with the magnitude of significant correlations being comparable to those that were obtained in the ITPA battery. This similarity of predictive utility with the teacher ratings is understandable given the high degree of relationship between the WISC intelligence measure and the ITPA battery in general. The shift in the magnitude of correlations between the kindergarten and first grade populations with the teacher follow-up ratings of school skills is difficult to interpret. In general, the magnitude of the moderate correlations in the SCREEN battery, the PIAT, the ITPA, and WISC increase in the first grade predictive study and in comparison to the kindergarten study with teacher ratings. The correlations with the teacher follow-up ratings of school skills are approximately ten to fifteen correlation points higher for some of these predictor measures in the fourth grade in comparison to those that were obtained in the third grade. Such correlational differences may be reflective of an emphasis on different school skills which are taught in kindergarten and first grade. Previous multiple regression analyses between the screening and the diagnostic measures with group achievement tests indicated that the combination of unique predictor variables within each assessment battery differed by grade. This result was interpreted as an indication that the skills necessary to predict future achievement in one grade do not necessarily correspond to the same underlying skills in another grade. In the present study, a similar result was obtained in that the significant ITPA and WISC subtest correlations with follow-up teacher ratings were generally on the language teacher rating scales rather than on the math and science scales. However, within the first grade sample the significant correlations of the ITPA and WISC were across all of the teacher rating scales.

It is interesting to note that the Experimental Phonetics Test which was administered in kindergarten produced the highest correlations in comparison to any of the other predictors with teacher ratings of school skills in the third grade. However, the significant correlations for the Phonetics Tests with the follow-up teacher ratings were in the same range as the other diagnostic and screening measures in the first grade. The drop in correlations with the Phonetics Test in the first grade population is a result of a ceiling effect with the majority of these children obtaining near-perfect scores. The high degree of a relationship between the Phonetics assessment in kindergarten and teacher ratings of reading, spelling and language 2½ years later is not surprising. In general, teachers are in tune with the child's oral language capabilities and general reading skills. The Phonetics measures which were utilized in the present study assessed skills which many teachers consider important for initial success in school. The implication of the latter result is that it would seem appropriate to include some type of basic phonetics scale in screening or diagnostic measures which are intended for assessment of kindergarten populations.

In general, the lack of some of the screening and diagnostic measures to significantly correlate with achievement criteria or teacher follow-up ratings of school skills should not be interpreted as being reflective of poor diagnostic utility. Correlational designs do not have the statistical capability of isolating subsamples of children who represent deviant performance groups. A particular screening or diagnostic measure, e.g., Self Concept and School Adjustment, may not significantly correlate with the school achievement or other measures of school success over a random sample. However, in an isolated sample of children who are relatively deviant on a particular measure or combination of measures, and are relatively homogeneous in comparison to other groups on the same measures, the degree of relationship with various criterion variables could be substantial. For example, Senf, Luick, and Larsen (1976) have found that there is a group of children who are deviant only on the Self Concept and School Adjustment measure of the SCREEN battery, and subsequently this group performs the lowest on various achievement measures in comparison to other isolated profile groups. Typically, the Self Concept and School Adjustment Index does not correlate with measures of school achievement over a random sample of the population. In essence, the differential diagnostic utility of measures cannot totally be determined through the use of correlational techniques over the general population. The present series of studies have indicated that even within a "high risk" population the degree of variance is still substantial. The diagnostic utility of such measures as the ITPA and WISC can best be assessed through isolating homogeneous subpopulations and determine if the deviant performance patterns differentially predict some set of criterion measures. A subsequent study will assess the diagnostic utility of the ITPA through cluster analytic procedures in relation to individual achievement and intelligence measures.

In conclusion, the predictive validity results that were obtained in the present series of studies should be interpreted in terms of each battery's underlying theoretical assumptions. SCREEN is a comprehensive child test and teacher assessment battery which was designed to identify school adjustment and skill problems in the early grades (primarily kindergarten and first grade). It is noteworthy that the teacher group administered SCREEN battery predicts achievement test criteria over a 2½ year period as well as or better than the more expensive individually administered diagnostic measures. In addition, the predictive validity coefficients for the SCREEN battery are as high as its concurrent validity coefficient in most cases. The evidence from this predictive validity study in conjunction with previous concurrent validity studies with the SCREEN battery indicates that this procedure is an adequate to substantial predictor of group administered and individually administered achievement tests. The ITPA battery was designed to assess dysfunctions which underlie various language processes. It was not specifically designed to predict school achievement measures. As such, these validity studies indicate that the ITPA has an adequate degree of relationship with measures of school achievement. As stated above, the diagnostic utility of this instrument cannot be determined through correlational designs over a sample of children who have such a wide range of skills. However, the primary intention of the WISC battery was to assess or predict school achievement across the general population. In order to accomplish this prediction purpose, various subscales were added to the WISC battery by its authors. The present series of studies have clearly indicated that the WISC scale is a relatively poor predictor of school achievement across a sample of children representing both a "high risk" and "normal" population. The designated purpose of the PIAT was to assess school achievement in a variety of school related areas. When group administered achievement batteries are utilized as criterion measures, the PIAT battery demonstrates moderate to substantial concurrent and predictive validity. Similarly, the Metropolitan series was found to have a moderate to substantial relationship to other measures of achievement. When predictor criterion measures have similar item content on at least some of their subscales, e.g., achievement tests, the degree of relationship is substantially increased in comparison to other more diverse measures.

CHAPTER V

STUDY FOUR

Method

The purposes of this study are twofold:

1. to investigate the utility of cluster analytic techniques in identifying more homogeneous subclusters of children who display specific performance patterns on the group administered early identification SCREEN test and on the individually administered ITPA;
2. to determine the relationship between the specific homogeneous performance patterns derived from these cluster analyses with individually administered diagnostic tests and other population characteristic data.

Subjects

This study utilized the total kindergarten and first grade sample which was described for Study One (p. 31). The descriptive characteristics of this population have been presented previously in Tables 1 and 2. The data collection procedure for this study is the same as that which was described in Study One. In general, the subjects were administered the SCREEN instrument in late May of 1974 by their regular classroom teachers. Within two to four months, each of the children in the kindergarten and first grade samples was administered a diagnostic battery of tests by an Illinois state certified diagnostician: the Illinois Test of Psycholinguistic Abilities (ITPA), the Wechsler Intelligence Scale for Children--Verbal subscales of Comprehension, Similarities, Vocabulary, and Digit Span (WISC), the Beery-Butenika Visual Motor Integration Test (VMI), the Peabody Individual Achievement Test (PIAT), and the Experimental Phonetics Test.

In the first portion of this study, the non-normalized t-scores (M = 50, SD = 10) for the nine major subscales for the SCREEN test battery (excluding General Readiness) were clustered analyzed in order to derive as homogeneous performance groups as possible within each grade. To determine whether or not the SCREEN performance profiles, cluster groups, were differentially related to performance on the criterion variables, a one-way analysis of variance (ANOVA) was conducted with each criterion variable utilizing the cluster group assignment as the independent variable. The dependent measures for the ANOVA included: the ITPA, PIAT, WISC, VMI, Phonetics Test, and age. A posteriori contrast test was utilized to systematically compare all possible pairs of group means for each criterion variable. In addition, frequency and cross-tabulation analyses were conducted on the descriptive population data associated with each cluster.

In the second portion of this study, the ITPA scaled scores (excluding the Psycholinguistic Quotient) were cluster analyzed within grade to derive as homogeneous groupings as possible. The ITPA scaled scores (M = 36, SD = 6) were used as the initial input for the cluster program. Follow-up analyses consisted of the same ANOVA analysis procedure as stated above for the criterion variables, followed by the posteriori contrast test and population data analyses.

Cluster Analysis Procedure. Anderberg (1973) developed the computer program which was used for the cluster analysis in this study. This hierarchial clustering procedure is an adaptation of the Ward procedure with the algorithm requiring computation of n (n - 1) similarity values and $\frac{1}{2}(3n^2 - 11n)$ comparisons. This particular stored data approach is implemented through Anderberg's (1973) subroutines MANAGE, GROUP, and PROC (Version 3). In this version, the average contribution to the error sum of squares for each member of the cluster is minimized, this quantity also being the variance of the new cluster which is generated. Hence, there is a very strong tendency to produce clusters of approximately equal variance. It is an agglomerative method that uses a minimum variance criteria because this approach calculates the similarity between clusters using the mean vector and some of squares vector for the comparison of clusters. In essence, clusters are generated based on the similarity of each child's scores in comparison with the scores of all the other children. Similar profiles are grouped together in a series of multi-comparison stages until one group is produced containing all the subjects. Once the clusters are calculated through this minimum variance criteria, the researcher must determine how many profile groupings are clinically different and internally homogeneous from a tree-like output with levels of variance and sequences of subject groups. Since there is the tendency for natural groupings to appear as several smaller clusters or for the smaller natural groups to merge into larger clusters, it is necessary to consider some branches of the cluster tree in great detail when making decisions as to the final number of clusters one wishes to examine for their predictive utility. This is accomplished by a second stage computer program which plots every child's subscores within each cluster and lists the mean profile and variance of each variable in every subcluster for comparison across groupings. Thus, one can inspect the actual data which was utilized in generating the cluster groupings while following the plot of increasing variance which is part of the initial program output. In this manner, clinical and statistically based decisions are made concerning the combination of some clusters and the separation of others. This iterative process allows one to select the cluster groupsings which are of primary clinical interest while retaining the power of the statistical criteria in the clustering procedure and is implemented through subroutines TREE and POSTDU (Anderberg, 1973).

Previous experimental work with the above subroutines (Luick, Agronowitz, & Busby, unpublished paper 1977; Senf, Luick, & Larsen, 1976) suggests a useful transformation of the initial data which is utilized as input into the cluster program. If one is interested in clinical profiles, high-low performance or most deviant performance on interval data (e.g., achievement or diagnostic tests), one can transform the middle distribution of scores into the sample mean, reducing the variance of these middle range scores to zero. This transformation of the data emphasizes those groupings which are of clinical interest and enhances the natural cluster groupings of the "normal" profiles. Such a procedure reduces the number of iterations that are needed in the second stage of the cluster program in selecting the optimal number of clusters which are of interest in subsequent analysis. In the present study, a conservative approach was utilized in reducing the middle 50% of the distribution to the appropriate sample means for the SCREEN and ITPA tests within grade. However, all post-test analyses used the original distribution of scores as input rather than their transformation. All cluster profile figures are plotted using the original distribution data, and one should note that this procedure does not change the overall level of the clustered profiles as one can expect an equal level of scores to fall above and below the mean for each variable.

For the present study, a third stage computer program was developed which permitted the coding of the cluster designations and subject sequence number from the cluster procedure with each individual subject's entire data set.[5] Previously, one had to group the subjects which corresponded to each cluster by hand sorting and add the variable code through keypunching or limit post analyses to correlational procedures (e.g., discriminant analysis) for determining which criterion variables best describe the data sets.

Analysis of Variance Procedure. The Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1976) was used for the one-way ANOVA and posteriori contrast analyses. This program allows for the automatic adjustment of unequal category frequencies

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5. This third stage computer program which utilizes the output from TREE and POSTDU was developed with the assistance of Dr. Michael R. Anderberg and Dr. David O. Anderson. Dr. Anderberg was also the major consultant for the clustering procedures and agrees that the data transformation procedure is a useful technique in isolating those cluster groups which are of the most clinical interest.

and tests for homogeneity of variance. A one-way analysis of variance was conducted on each criterion variable following each of the cluster analyses within grade, utilizing the coded cluster designation as the independent variable. Outlying clusters were not used as input for the ANOVA calculations as their subject frequency is too small for statistical stability. A conservative approach was adopted in choosing the posteriori contrast method. The LSDMOD procedure was selected as this technique uses a single range value for testing all differences between all possible pairs of group means ($p < .05$). This posteriori contrast procedure is derived from the least significant difference technique but transforms the student's t according to the following error rate definition: Alpha = number of errors/number of experiments. With the exception of the Scheffe comparison procedure, the LSDMOD is the most conservative and is exact for unequal group sizes.

Results: SCREEN Cluster and ANOVA Analyses for Kindergarten

The results of the original cluster analysis on the nine major SCREEN subscores for the total kindergarten sample yielded 21 relatively homogeneous profile groups, a theoretical reduction by over 94% of 376 possible individual unique profiles. Of these 21 clusters, six could be combined into three relatively homogeneous clusters while retaining significant homogeneity within the new cluster groups. These six common performance groups originally formed separate clusters because of varying degrees of average performance on all but one SCREEN subscore. Since varying degrees of normality are not clinically significant, each cluster was combined with a group that exhibited deviant performance on the same SCREEN variable. Therefore, the final selection of relatively homogeneous clusters consisted of 18 different SCREEN performance groups ranging in size from an N of 6 to 53 with no outlying cluster groups. Technically, outlying clusters contain few subjects who have vastly divergent scores on only one or two variables in comparison to the other relatively homogeneous groups. These 18 clusters contain 100% of the subjects in the total kindergarten sample and represent a reduction by over 95% in the number of possible unique profiles.

The results of the analysis of variance of the SCREEN clusters with the various criterion variables (Table 43) are contained in Table 44 through Table 47. The left-hand column of each table contains the cluster designation with the corresponding number of subjects in each group. The means and standard deviations within each cluster for each criterion variable are listed to the right of their cluster group designation, and the total mean and standard deviation for each criterion variable across clusters is presented at the bottom of each table with the F ratio and level of significance. The overall ANOVA F test was significant for each criterion variable. However, not all the criterion variables had significant posteriori contrasts in comparing all possible pairs of group means. Only those diagnostic criterion variables associated with each cluster which were significantly below or above average according to the posteriori contrast analysis will be presented at the bottom of each cluster figure. The following scores and ranges for each diagnostic test associated with each cluster are reported: ITPA, the mean scaled score (M-S.S.); PIAT and WISC, mean percentile (M-%tile), derived from the norm tables for

Table 43

Variable List for SCREEN Clusters and ITPA Clusters Tables

Variable Abbreviation	Variable Name
	ITPA
Aud. As.	Auditory Association
Aud. S. M.	Auditory Sequential Memory
Aud. Rec.	Auditory Reception
Vis. Rec.	Visual Reception
Vis. S. M.	Visual Sequential Memory
Vis. As.	Visual Association
Vis. Cl.	Visual Closure
Ver. Ex.	Verbal Expression
Gra. Cl.	Grammatic Closure
Man. Ex.	Manual Expression
Aud. Cl.	Auditory Closure
Sd. Bl.	Sound Blending
PLQ	Psycholinguistic Quotient
	PIAT
Math	Math
Read. Rec.	Reading Recognition
Read. Com.	Reading Comprehension
Spel.	Spelling
Gen. Inf.	General Information
Total	Total
	WISC-Verbal
Comp.	Comprehension
Sim.	Similarities
Voc.	Vocabulary
Digit Span	Digit Span
Verbal IQ	Verbal IQ
	VMI
VMI	Beery Developmental Test of Visual Motor Integration
	Phonetics Test (Experimental)
Init. Cons.	Initial Consonants
L & S Vowels	Long & Short Vowels
Final Cons.	Final Consonants
Cons. Blends	Consonant Blends
Total	Total

Table 44

ANOVA for SCREEN Clusters with the ITPA
(Kindergarten)

Cluster Number	N		Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
1	53	M	39.45	37.85	38.70	38.11	37.83	38.08	38.09	38.49	37.51	39.70	37.09	45.38	108.57
		SD	6.68	7.09	7.76	6.25	5.86	5.83	5.76	6.54	6.74	5.92	6.93	11.57	11.92
2	23	M	38.52	37.70	37.26	38.83	34.91	39.30	36.13	37.30	37.35	37.74	34.74	42.35	105.74
		SD	5.95	8.31	7.76	5.82	6.24	6.36	7.57	6.41	5.48	7.42	5.73	8.95	15.28
3	11	M	44.18	35.36	44.91	39.64	38.36	47.36	38.45	38.64	41.56	41.73	38.27	44.00	114.36
		SD	3.68	5.55	6.07	6.25	6.17	5.66	7.53	3.53	8.03	5.61	5.08	9.02	11.19
4	51	M	43.53	51.49	41.14	38.59	40.12	40.69	39.86	36.90	42.18	39.57	39.22	48.71	113.39
		SD	6.35	6.90	6.14	5.66	8.38	4.56	6.18	5.46	5.92	5.29	5.39	9.75	11.66
5	6	M	38.00	41.00	36.83	36.33	33.83	36.17	42.83	41.33	35.83	42.83	34.00	44.17	110.00
		SD	5.48	6.63	5.19	6.44	8.57	7.00	8.52	9.54	2.40	5.81	2.68	10.82	17.23
6	20	M	40.85	37.55	36.10	37.75	37.10	38.20	37.50	37.95	39.20	41.65	36.85	47.85	105.70
		SD	4.73	6.48	6.66	5.39	7.09	5.81	5.93	6.59	4.77	5.69	5.02	9.79	7.34
7	9	M	38.78	37.11	36.78	34.22	34.00	34.33	32.33	31.00	33.67	38.00	33.56	37.78	97.44
		SD	3.77	8.55	7.63	9.02	6.36	7.92	5.15	4.85	4.30	7.83	3.90	6.18	12.55
9	43	M	40.72	36.95	39.53	40.70	37.09	40.35	37.86	37.53	39.93	40.07	38.35	47.42	109.47
		SD	6.92	6.32	7.53	6.08	7.66	4.32	6.92	6.39	6.08	5.19	5.97	10.25	12.44
10	10	M	39.90	34.80	39.40	41.90	34.00	40.10	39.60	37.90	41.20	40.80	40.50	44.10	110.70
		SD	6.81	4.80	7.56	5.59	9.18	6.12	6.48	7.88	6.55	4.32	4.58	11.57	12.09

Table 44, Continued

Cluster Number	N		Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
11	7	M	41.00	33.71	40.29	40.00	32.71	34.57	38.14	39.86	39.29	40.57	37.14	39.43	112.43
		SD	8.49	4.15	9.34	8.31	5.62	5.65	3.34	5.84	8.79	4.43	5.58	9.02	20.11
12	9	M	39.33	32.56	36.33	37.00	36.00	39.44	35.89	39.11	37.11	43.56	35.89	38.33	106.22
		SD	5.70	5.48	8.34	6.10	5.02	4.00	6.27	6.49	8.02	4.95	7.49	6.60	12.79
13	30	M	37.60	32.07	35.17	36.23	35.13	36.37	35.90	35.27	36.10	37.70	34.87	37.67	98.57
		SD	7.40	5.81	6.39	6.24	6.69	5.90	5.84	5.06	4.84	4.97	6.62	7.72	8.16
14	23	M	37.87	36.13	38.52	36.70	32.83	36.00	37.00	36.74	35.00	39.00	33.78	40.48	102.86
		SD	6.59	7.36	7.41	6.61	6.62	5.46	7.15	6.11	7.25	5.62	5.41	10.56	10.17
15	8	M	29.25	32.75	30.88	34.38	32.75	30.88	30.88	34.50	29.00	35.63	30.25	35.50	89.62
		SD	4.13	4.89	4.52	5.21	5.44	5.17	6.10	5.55	5.01	4.69	4.06	6.63	6.46
16	25	M	34.32	33.00	33.20	38.16	36.56	36.60	37.68	34.24	34.24	36.04	32.36	37.52	97.20
		SD	5.23	5.12	5.58	5.06	9.27	5.15	5.51	5.86	4.69	6.60	7.44	10.65	9.25
17	18	M	31.89	33.22	34.50	35.83	30.56	35.33	34.67	34.22	31.78	37.50	35.72	35.44	94.72
		SD	5.78	7.13	9.36	6.04	6.36	5.98	3.36	4.67	5.63	5.85	5.28	9.34	10.20
19	13	M	37.77	34.92	36.62	38.23	37.77	36.62	33.46	36.23	33.77	38.31	33.46	43.23	100.08
		SD	4.90	5.33	8.25	7.37	5.45	5.04	6.69	6.78	4.34	5.94	6.51	10.61	13.67
21	17	M	31.00	32.82	32.76	35.65	31.53	34.06	32.59	34.47	29.71	36.12	29.88	33.71	92.47
		SD	5.85	4.95	7.14	4.94	5.78	6.31	4.81	7.05	5.53	8.23	7.64	6.64	8.32
Total		M	38.70	36.07	37.63	38.00	36.12	38.07	37.10	36.76	37.20	39.07	35.97	42.73	105.01
N = 376		SD	7.09	6.85	7.62	6.20	7.40	6.07	6.46	6.25	6.83	6.01	6.50	10.67	13.14
		F	7.56	3.29	3.67	1.79	3.09	5.68	3.05	2.03	7.82	2.10	4.31	5.24	7.59
		P	.0001	.0001	.0001	.03	.0001	.0001	.0001	.009	.0001	.007	.0001	.0001	.0001

Table 45

ANOVA for SCREEN Clusters with the PIAT*
(Kindergarten)

Cluster Number	N		Math	Read. Rec.	Spel.	Gen. Inf.	Total
1	53	M	103.11	104.42	104.91	102.25	102.38
		SD	10.18	7.09	8.30	10.50	8.39
2	23	M	99.09	103.96	102.96	102.78	101.00
		SD	10.29	8.06	7.83	8.95	7.17
3	11	M	112.82	108.55	107.00	107.36	109.18
		SD	6.19	11.40	11.88	6.86	9.79
4	51	M	107.65	110.88	109.88	108.33	109.20
		SD	9.40	12.99	11.05	8.82	10.03
5	6	M	100.83	109.83	104.00	104.00	104.17
		SD	4.88	13.53	10.81	7.24	9.64
6	20	M	103.70	104.30	103.30	103.65	101.55
		SD	8.81	6.84	6.42	8.90	6.84
7	9	M	95.67	97.00	97.22	93.67	92.33
		SD	6.52	6.27	5.07	10.44	6.04
9	43	M	101.16	107.12	104.47	104.67	103.63
		SD	9.78	10.12	9.77	8.77	9.53
10	10	M	103.40	103.60	102.30	110.20	103.50
		SD	9.95	7.28	9.52	8.15	7.69
11	7	M	93.14	99.00	99.71	100.00	96.00
		SD	9.44	12.58	7.91	9.68	9.90
12	9	M	96.89	99.56	94.33	105.33	97.11
		SD	7.51	8.75	7.66	8.79	9.47
13	30	M	96.47	97.67	97.57	96.93	94.60
		SD	9.95	7.10	6.47	11.36	8.32
14	23	M	97.65	101.70	102.13	103.17	98.83
		SD	7.81	10.06	8.92	10.11	8.75
15	8	M	84.13	89.13	89.50	89.75	83.50
		SD	11.47	11.68	5.45	11.15	7.27

Table 45, Continued

Cluster Number	N		Math	Read. Rec.	Spel.	Gen. Inf.	Total
16	25	M	92.00	96.52	95.20	94.12	92.20
		SD	6.68	7.39	5.89	9.38	6.88
17	18	M	95.28	100.89	97.78	95.33	95.94
		SD	10.67	10.43	8.71	11.03	10.08
19	13	M	99.15	104.62	102.62	99.00	99.15
		SD	6.11	9.99	11.69	9.65	8.98
21	16	M	92.88	95.63	94.94	92.38	91.06
		SD	7.54	11.57	8.90	8.48	9.20
Total N = 375		M	100.07	103.26	102.19	101.63	100.27
		SD	10.53	10.71	9.97	10.70	10.41
		F	8.25	6.11	6.82	6.48	10.24
		p	.0001	.0001	.0001	.0001	.0001

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* The majority of the kindergarten sample did not receive the Reading Comprehension subtest.

Table 46

ANOVA for SCREEN Clusters with the WISC and VMI (Kindergarten)

Cluster Number	N*		WISC					
			Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
1	53	M	11.15	10.94	10.25	10.62	53.71	74.04
		SD	3.79	3.39	2.88	2.92	11.96	11.97
2	23	M	9.97	10.56	9.83	10.26	50.74	71.82
		SD	3.18	4.03	2.71	2.43	10.79	10.57
3	11	M	10.67	13.36	11.00	10.73	56.44	83.91
		SD	2.87	3.83	2.90	1.90	10.17	12.48
4	51	M	11.12	13.39	10.88	11.53	58.82	79.57
		SD	3.23	3.29	2.78	2.69	10.01	11.54
5	5	M	11.40	13.80	9.00	9.60	55.00	79.00
		SD	.89	3.27	3.74	1.82	5.79	15.82
6	20	M	10.47	11.85	10.25	10.05	53.58	69.65
		SD	3.60	3.33	3.34	3.19	11.53	6.39
7	9	M	9.44	8.89	7.44	9.00	43.78	59.78
		SD	3.91	3.52	3.09	2.40	12.01	4.63
9	43	M	11.30	11.60	10.56	10.79	55.44	71.93
		SD	3.20	3.51	3.36	2.13	11.26	10.07
10	10	M	10.30	12.10	9.90	10.50	53.60	69.00
		SD	4.06	3.25	3.63	2.27	9.88	7.86
11	7	M	11.57	10.71	9.29	8.86	50.43	66.57
		SD	2.23	2.63	4.11	2.27	11.16	6.65
12	9	M	12.33	11.56	10.22	8.56	53.44	67.78
		SD	2.35	3.13	1.79	2.35	5.64	5.95
13	30	M	9.53	9.90	8.60	7.87	45.00	68.20
		SD	3.21	2.64	2.97	2.65	9.95	8.55
14	23	M	10.04	11.09	9.00	10.57	50.91	70.70
		SD	3.80	3.00	3.42	2.71	12.12	6.15

Table 46, Continued

Cluster Number	N		WISC Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
15	8	M	8.88	8.87	7.25	7.00	40.00	63.25
		SD	1.46	2.80	3.38	2.07	6.30	6.92
16	25	M	8.96	9.20	8.04	8.68	43.60	71.28
		SD	2.70	3.30	3.32	1.84	9.66	10.26
17	18	M	9.47	8.22	8.82	8.33	43.50	69.33
		SD	2.87	3.41	2.81	2.84	11.54	7.74
19	13	M	9.92	10.38	10.00	9.23	49.46	68.00
		SD	4.01	2.75	3.00	2.77	8.76	5.03
21	17	M	8.41	7.94	7.53	8.18	41.12	62.94
		SD	3.00	2.90	2.29	2.32	7.35	8.19
Total N = 375		M	10.37	10.96	9.64	9.88	51.14	71.76
		SD	3.36	3.59	3.16	2.79	11.70	10.78
		F	1.80	5.09	2.90	5.25	6.01	6.04
		p	.02	.0001	.0001	.0001	.0001	.0001

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* Those subjects with various subtests missing are not included in the analyses (N = 6).

Table 47

ANOVA for SCREEN Clusters with the Phonetics Test and Age
(Kindergarten)

Cluster Number	N*		Phonetics Test Init. Cons.	Phonetics Test L & S Vowels	Final Cons.	Cons. Blends	Total	Age
1	52	M	2.17	6.16	4.33	4.88	17.34	73.91
		SD	2.51	1.73	3.32	2.64	8.16	3.50
2	22	M	1.41	5.86	2.57	4.29	13.81	75.43
		SD	2.32	2.20	2.04	2.63	6.74	3.73
3	11	M	1.00	3.82	1.64	3.45	9.91	75.55
		SD	2.09	2.68	2.25	2.16	7.66	3.75
4	51	M	.35	3.63	.84	1.80	6.42	76.49
		SD	1.13	2.24	1.54	1.96	5.08	3.67
5	6	M	2.17	5.83	3.17	4.40	15.40	76.00
		SD	2.64	2.71	3.19	4.04	11.84	4.00
6	19	M	2.00	6.22	4.74	5.72	18.22	74.15
		SD	1.97	2.24	3.11	2.85	7.91	3.01
7	8	M	3.50	7.13	6.75	7.25	24.75	75.33
		SD	2.73	1.25	1.98	1.83	5.47	5.63
9	43	M	1.74	5.72	3.36	4.37	14.93	74.02
		SD	2.17	2.37	2.84	2.94	8.36	3.41
10	10	M	1.10	6.11	2.30	3.20	13.44	75.50
		SD	1.60	2.37	2.83	3.01	8.92	3.98
11	7	M	5.14	6.60	6.33	6.20	24.00	74.71
		SD	2.97	1.82	2.88	3.03	10.31	5.41
12	9	M	4.22	6.22	5.56	5.00	21.00	76.78
		SD	3.38	2.05	2.30	3.12	8.70	2.82
13	30	M	4.70	7.03	6.50	6.90	25.34	74.13
		SD	3.00	1.54	2.05	1.61	5.81	3.46
14	23	M	4.35	7.00	6.14	5.60	22.85	72.26
		SD	3.30	1.63	2.69	2.35	8.50	3.48

Table 47, Continued

Cluster Number	N		Phonetics Test					
			Init. Cons.	L & S Vowels	Final Cons.	Cons. Blends	Total	Age
15	7	M	7.43	7.83	7.57	7.43	30.67	71.25
		SD	1.27	.75	.98	.79	.52	2.38
16	24	M	4.63	6.75	6.24	6.35	23.95	76.28
		SD	3.72	1.41	2.26	2.21	7.49	3.48
17	16	M	4,19	6.31	6.43	6.23	23.75	75.94
		SD	2.71	1.55	1.65	2.55	6.82	2.94
19	12	M	3.50	6.50	6.33	7.00	23.33	72.85
		SD	3.32	1.47	2.42	1.86	6.58	3.56
21	14	M	6.57	7.08	7.33	7.91	28.45	73.59
		SD	2.24	1.12	1.61	.70	4.06	4.49
Total		M	2.79	5.91	4.31	4.93	17.70	74.68
N = 364		SD	3.05	2.23	3.19	2.93	9.69	3.79
		F	11.02	7.08	14.57	10.13	16.36	3.14
		p	.0001	.0001	.0001	.0001	.0001	.0001

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* Those subjects with various subtests missing are not included in the analyses (N = 12).

each test and including the 95% confidence interval for each mean (95% Conf. Int.). The word "Yes" for the VMI and the listing of a Phonetics subtest indicates significant contrast comparisons for that cluster. The word "None" next to a diagnostic test or when a subtest is not listed indicates that the cluster group represented in the corresponding figure performed at an average level on each subtest and total score.

There are seven relatively homogeneous SCREEN clusters in the kindergarten sample (representing groups of children who have common deficits on various SCREEN subtests) which are significantly related to below average performance on the various individually administered diagnostic tests, and there are seven clusters (representing groups of children who have above average performance on various SCREEN subtests) which are significantly related to above average diagnostic performance according to the least significant difference posteriori constrast comparison tests. The figures illustrating the mean SCREEN profiles derived from the 18 clusters in the kindergarten sample are presented in Appendix D (Figure 1 through Figure 18). Within the kindergarten sample, the Chi-square analysis was not significant for the sex and class placement variables. However, the cell frequencies for each of these categories are presented at the top of each figure for general information purposes. Since an overall Chi-square across a large number of independent variables (18 clusters) with varying cell frequencies can overlook a few highly disproportionate cells, an asterisk beside sex and class placement on a figure will indicate extreme divergence from an expected percentage which may be of clinical interest. In the kindergarten sample, there are

134 females (35.6%), 242 males (64.4%), 267 regular class placements (71.0%), and 109 opens space class placements (29.0%). According to the posteriori contrast analysis, there was not a significant age group difference between the SCREEN cluster comparisons in the kindergarten sample.

Figure 1 (Cluster 7) illustrates the mean SCREEN performance profile of nine subjects from regular classes derived from the cluster analysis, representing 2.4% of the total kindergarten population. On the SCREEN test profile, the higher the t-score is above the mean (M = 50, SD = 10) the greater is the potential "high risk" for school skill and adjustment problems, e.g., a t-score of approximately 58 or above on any of the subtests. Cluster 7 represents a group of children who have Figure Copying, Basic Knowledge, and Cognitive-Perceptual Skill problems with some subjects having Visual Skills problems and slightly deviant Social Adjustment and Immaturity ratings by the teacher. Accordingly, this group performs significantly below average on the Math, Reading Recognition, Spelling, General Information, and Total scores of the PIAT. One can note that 97.5% of the subjects in this cluster group perform between the 20th and 41st percentile on the total achievement score. Generally, these nine subjects have Verbal IQ's ranging from 81 to 104, have significant below age performance on the VMI, have below average scores on the Grammatic Closure subtest of the ITPA, and have significant difficulty with long and short vowels as indicated by the Experimental Phonetics Test.

Figure 2 (Cluster 12) contains a group of subjects who are indicated as having significant problems in Self Concept and School

Adjustment, Auditory Skills, and teacher ratings of Behavioral Adjustment, with only some "high risk" teacher ratings in Cognitive-Perceptual Skills and Immaturity. It is interesting to note that all nine of the subjects in this cluster are males with significant below average performance on the PIAT Spelling subtest and no other indications of below average performance on the other diagnostic tests.

Figure 3 (Cluster 13) represents a relatively large cluster group of 30 children, 8.0% of the total kindergarten sample. This group of children, 80% of whom are males, has significant problems with Figure Copying skills and are rated by the teacher as having Cognitive-Perceptual Skill problems, with minor group problems in Self Concept and School Adjustment and teacher ratings of Behavioral Adjustment. This SCREEN profile is indicative of children that have approximately half a standard deviation below average performance on all achievement tests. In addition, 97.5% of this group have Verbal IQ's ranging from 89 to 99 and have significant below average performance on the WISC Digit Span subtest (97.5% ranging from the 16th percentile to the 37th percentile). These children also have significant below average performance across the various Phonetics skills as indicated in Figure 3.

Figure 4 (Cluster 15) contains eight subjects representing 2.1% of the total kindergarten sample. These subjects have significant "high risk" performance in Visual Skills, Auditory Skills, and Basic Knowledge, with some indications of Self Concept and School Adjustment problems and Cognitive-Perceptual Skill deficits as rated by the teacher. This group of children has significant below average performance on all of the criterion diagnostic tests. On the PIAT subtests (Math through General Information), 97.5% of these subjects performed between the 8th and 47th percentile, and the mean total achievement score for the group is one standard deviation below the mean, 97.5% of the scores ranging from the 6th to the 24th percentile. On the WISC Digit Span, 97.5% of the subjects score between the 5th and 37th percentile, and 97.5% of the subjects in this cluster have Verbal IQ's ranging between 81 and 94. In addition, the group mean on five of the ITPA subtests is one standard deviation below the norm, and these children have below average Phonetics skills.

Figure 5 (Cluster 16 plus Cluster 18) contains 25 subjects representing 6.6% of the total kindergarten sample. This cluster of children has deviant performance only on the Visual Skills subtest of the SCREEN battery. In correspondence, children with such a SCREEN profile have significant below average performance on all of the PIAT subtests, one ITPA subtest and the PLQ, WISC Verbal IQ, and three of the Phonetics subtests. Generally, one can state that 97.5% of these subjects have Verbal IQ's between 87 and 97, and 97.5% of these subjects have a total achievement socre between the 23rd and 37th percentile.

Figure 6 (Cluster 17) illustrates a relatively pure Auditory Skills deficit group on the SCREEN performance profile with some of the children having the Self Concept and School Adjustment and the Basic Knowledge subtests in the "high risk" range. Accordingly, this cluster of 18 children, representing 4.8% of the total kindergarten sample, have significant below average performance on the Math, General Information, and Total PIAT scores. This group also has mean scores approximately one standard deviation below the norm on the Auditory Association, Visual Sequential Memory, and Grammatic Closure subtests of the ITPA, and 97.5% of the group have a Verbal IQ between 84 and 100. One should note that the SCREEN clusters presented in Figure 5 and Figure 6, a total of 11.4% of the kindergarten sample, have relatively pure "high risk" performance in Visual or Auditory skills with teacher ratings of Cognitive-Perceptual Skills and other rating areas in the average or superior range.

In contrast to the latter two clusters, the teacher ratings of Cognitive-Perceptual Skills and Social Adjustment are congruent with the next group's deficit performance on the Visual, Auditory, and Basic Knowledge child tests, Figure 7 (Cluster 21). Seven of the ITPA subtests and all of the PIAT scales are significantly below average. This group of children has the lowest Verbal IQ in comparison to the other clusters (Mean = 89) and performs below average in all of the Phonetics skill areas.

Figure 8 (Cluster 4) contains 51 subjects representing 13.6% of the kindergarten sample. This cluster contains subjects who have significant above average performance on all the subtests of the SCREEN battery. In correspondence, all of the diagnostic tests indicate significant above average performance. For example, this group has superior scores on the ITPA (Mean PLQ = 113), the PIAT (Mean Total = 109), and the WISC (Mean Verbal IQ = 111).

Figure 9 (Cluster 5) contains six subjects representing 1.6% of the total kindergarten sample. Subjects in this cluster have significant below average performance on the SCREEN Auditory Skills subtest with extremely low performance on teacher ratings of Social Adjustment. To place the profile in better perspective, scores on the Auditory Skills subtest of the SCREEN battery for these six subjects range from 54 to 73, and the scores for the teacher ratings of Social Adjustment range from 69 to 84. Hence, only two of the subjects have Auditory Skills problems while all the subjects have been rated by the teacher as having Social Adjustment problems. There is a great deal of variance for this group in the corresponding significant above average performance on the Reading Recognition subtest of the PIAT battery (Mean = 109.83, with 97.5% of the subjects ranging between the 36th and 94th percentile). One can state that there is a correspondence between the Auditory Skills deficits and Reading Recognition problems with some of these children also having Social Adjustment problems as indicated by the teacher with no other corresponding diagnostic deficits.

Figure 10 (Cluster 3) is an interesting SCREEN profile containing ten male subjects and only one female subject. The teacher ratings indicate that these children have significant Behavioral Adjustment problems while the child skill tests indicate that they are above average performers in academic areas. The diagnostic assessment agrees with the child test screening areas as this cluster of children performs significantly above average on the ITPA, PIAT, VMI, Phonetics Test, and scores in the average range on the WISC.

Figure 11 (Cluster 10) represents a SCREEN cluster performance group containing eight male subjects and only two female subjects. The teacher ratings on the SCREEN battery indicate that these children have significant Behavioral Adjustment and Immaturity problems with no problems being indicated on the skill subtests. Similar to the last two cluster groups, teacher "high risk" ratings only on Behavioral Adjustment, Social Adjustment, or Immaturity do not correspond to below average academic performance but, rather, to above average scores on various subtests of the ITPA and PIAT and average WISC performance. One should note that these latter three cluster groups contain 81% boys who are seen by the teacher as having disruptive behaviors, poor social skills, or other significant below age behaviors.

Interestingly enough, there is another teacher rating cluster containing 60% girls who are rated as having Social Adjustment and major Immaturity problems, Figure 12 (Cluster 6 plus Cluster 8). Again, these children have average or superior performance on the SCREEN skill areas with corresponding above average or average scores on the various diagnostic tests.

Figure 13 (Cluster 11) represents a small group of five children who have significant "high risk" teacher ratings. Teachers rate this group of 70% boys as having significant problems on all four of the rating scales, with no corresponding deficits indicated on the child test portion of the SCREEN battery. This type of SCREEN profile represents a group of children who perform significantly above average on the Auditory Association and PLQ areas of the ITPA. However, half of the group performs below average on the Math and Total PIAT scores.

Figure 14 (Cluster 9) illustrates a relatively large group of 43 subjects who have average to superior scores on the SCREEN battery.

Various subtests of the ITPA and PIAT concur with this cluster having significant above average academic performance. Similarly, Figure 15 (Cluster 1) containing 53 children with average SCREEN skill scores and superior teacher ratings have no significant above or below average diagnostic scores.

The three remaining SCREEN clusters in the kindergatten sample do not have significant above or below average scores on any of the diagnostic criterion variables. Figure 16 (Cluster 14) contains another group of 23 subjects, 70% boys, who have been rated by the teacher to have significant Cognitive-Perceptual Skills, Social Adjustment, and Immaturity deficits with no corresponding problems on the child skill test portion of the SCREEN battery. Figure 17 (Cluster 2 plus Cluster 20) represents a group of 23 children indicated to have significant Self Concept and School Adjustment problems with no corresponding skill deficits or teacher rating problems. Figure 18 (Cluster 19) represents a group of 13 subjects who have been indicated to have Self Concept and School Adjustment problems with corresponding low performance in Basic Knowledge.

Results: SCREEN Cluster and ANOVA Analyses for First Grade

The results of the cluster analysis for the nine SCREEN variables for the first grade sample yielded 14 clusters ranging in size from an N of 2 (the one outlying cluster) to an N of 101. These 14 relatively homogeneous SCREEN performance profiles contain 100% of the subjects and represent a theoretical reduction of 388 possible unique profiles by over

96%. The sequence order in which the subjects entered the cluster grouping was retained as originally produced as it was not necessary to combine various cluster groups because of similar average performance on the majority of variables as occurred in the kindergarten sample. The one way ANOVA analysis was significant for all diagnostic subtests with the exception of Visual Sequential Memory and the Manual Expression subtest of the ITPA and age across the cluster groups (Table 48 through Table 51). Those diagnostic criterion variables which produced significant least-significant difference comparisons will be indicated at the bottom of each cluster figure in Appendix E (Figure 19 through Figure 32). The Chi-square across sex by cluster designation was significant in the first grade sample ($\underline{X}^2 = 39.57$, df = 12, $\underline{p} < .001$) but was not significant for class placement. In the first grade sample, there are 148 females (38.1%), 240 males (61.9%), 298 regular class placements (76.8%), and 90 open space class placements (23.2%). There are six relatively homogeneous "high risk" clusters in the first grade which are significantly related to below average performance on the individually administered diagnostic tests, and there are four superior performance SCREEN clusters which are related to significant above average performance on the criterion measures.

Figure 19 (Cluster 6) contains one female subject and five males, representing 1.5% of the total first grade sample. According to the SCREEN test profile, this cluster has significant Auditory Skills, Visual Skills, and Basic Knowledge problems with a few indications of "high risk" Self Concept and School Adjustment, teacher ratings of Cognitive-Perceptual Skills, and Behavioral Adjustment. This cluster represents

Table 48

ANOVA for SCREEN Clusters with the ITPA (First Grade)

Cluster Number	N		Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
1	21	M	36.00	35.29	37.95	38.10	33.14	35.43	38.29	33.52	35.38	41.38	36.90	39.52	102.67
		SD	7.87	5.60	6.41	5.11	9.73	5.30	5.06	4.63	6.14	6.58	4.71	7.88	10.07
2	7	M	42.14	34.29	42.00	42.14	37.14	38.14	40.00	37.71	42.86	42.14	37.00	48.86	113.29
		SD	5.64	6.80	4.76	4.06	6.89	7.54	9.64	6.24	7.06	4.49	3.79	5.67	9.60
3	9	M	37.67	38.33	35.67	36.89	35.00	38.33	34.22	34.67	39.56	37.78	32.11	46.56	101.11
		SD	6.46	7.38	4.85	5.13	7.25	5.61	5.12	3.39	6.50	3.46	6.70	4.25	7.42
4	80	M	40.19	36.29	38.90	36.59	36.08	37.08	36.20	34.43	39.20	38.45	36.90	43.28	104.41
		SD	5.78	7.23	6.13	5.91	7.59	7.09	6.04	6.07	6.57	6.54	6.47	6.38	12.43
5	24	M	39.13	36.21	40.08	35.46	36.04	34.46	35.00	35.42	37.96	39.33	35.04	41.33	102.79
		SD	4.70	5.15	6.68	6.85	8.53	5.06	6.14	7.58	6.86	4.58	5.03	7.28	11.74
6	6	M	31.00	28.33	30.67	31.50	31.83	36.67	33.17	32.50	32.33	37.50	29.17	38.50	89.50
		SD	8.32	6.89	6.02	9.73	10.72	5.65	9.09	5.79	8.57	4.23	7.44	5.65	18.89
7	45	M	34.91	34.20	34.76	36.78	33.24	32.62	34.07	35.00	34.67	37.96	34.33	40.89	96.31
		SD	5.86	7.92	7.05	6.07	6.72	5.96	5.84	6.32	7.22	5.97	5.88	8.67	8.77
8	12	M	37.83	38.00	39.42	37.00	33.25	37.33	37.92	35.00	35.00	41.25	35.33	40.67	105.75
		SD	8.88	7.95	7.88	9.23	7.83	4.10	5.82	4.75	6.72	5.74	6.04	7.27	16.56
9	25	M	40.12	36.60	36.80	36.44	35.68	35.84	35.00	32.92	37.92	38.00	34.20	44.44	101.12
		SD	5.46	9.58	5.87	5.33	10.24	4.89	6.23	5.72	5.64	6.93	5.93	6.59	12.77

Table 48, Continued

Cluster Number	N		Aud. As.	Aud. S. M.	Aud. Rec.	Vis. Rec.	Vis. S. M.	Vis. As.	Vis. Cl.	Ver. Ex.	Gra. Cl.	Man. Ex.	Aud. Cl.	Sd. Bl.	PLQ
10	11	M	32.18	29.00	36.09	33.91	35.36	34.18	37.36	34.55	32.27	39.27	30.18	39.09	94.81
		SD	5.60	6.47	6.41	5.19	10.45	4.94	7.59	4.50	7.56	4.65	6.30	7.46	6.94
11	14	M	36.29	33.50	36.43	38.00	34.43	36.07	36.57	32.64	31.43	40.14	30.79	37.21	98.43
		SD	6.38	7.07	6.91	4.17	7.21	5.23	5.49	5.11	9.21	6.46	5.83	7.60	11.57
12	31	M	39.06	38.68	39.58	37.13	35.84	38.58	36.90	37.29	38.16	39.71	35.84	43.32	107.35
		SD	5.46	8.76	5.53	5.38	8.96	5.14	6.95	5.96	5.42	5.44	5.36	6.57	10.03
13	101	M	41.11	36.79	39.73	39.05	36.85	38.44	38.53	36.94	39.06	39.15	37.02	44.20	108.90
		SD	6.16	7.96	5.98	5.69	7.36	7.23	6.54	6.15	6.33	5.42	5.36	5.71	12.49
Total		M	38.82	35.96	38.27	37.32	35.50	36.63	36.66	35.29	37.54	39.07	35.56	42.68	103.87
N = 386		SD	6.55	7.77	6.48	6.02	8.04	6.50	6.45	6.07	6.95	5.84	6.01	7.00	12.53
		F	5.87	2.23	3.45	2.34	.96	3.07	2.28	2.02	4.27	1.01	3.82	3.41	5.49
		p	.0001	.01	.0001	.007	NS	.0001	.008	.02	.0001	NS	.0001	.0001	.0001
14*		M	34.50	35.50	42.50	43.00	40.00	40.50	39.50	32.50	34.50	35.00	33.00	40.50	106.00
N = 2		SD	12.02	10.61	2.12	1.41	1.41	4.95	7.78	3.54	12.02	2.83	1.41	4.95	24.04

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* Outlying cluster not included in ANOVA analyses.

Table 49

ANOVA for SCREEN Clusters with the PIAT
(First Grade)

Cluster Number	N		Math	Read. Rec.	Read. Comp.*	Spel.	Gen. Inf.	Total
1	21	M	98.19	96.90	100.00	95.52	99.57	95.62
		SD	7.63	7.85	6.89	7.55	8.90	6.62
2	7	M	103.29	112.57	112.71	107.86	107.43	108.43
		SD	7.11	12.57	9.11	12.39	14.21	10.83
3	9	M	103.78	106.89	105.44	104.56	102.00	103.44
		SD	9.28	10.69	9.18	11.18	7.73	8.73
4	80	M	102.06	105.75	105.00	103.65	103.28	102.73
		SD	9.35	11.35	9.64	11.10	10.51	9.85
5	24	M	101.21	101.08	101.45	99.13	103.29	99.17
		SD	7.39	12.87	10.27	12.19	11.11	10.16
6	6	M	83.00	96.00	106.00	92.17	92.17	90.33
		SD	15.14	15.50	4.36	16.52	16.30	14.87
7	45	M	93.78	98.36	100.98	97.11	92.96	94.22
		SD	7.83	9.79	7.94	9.81	9.20	8.34
8	12	M	96.08	97.17	100.64	95.00	98.50	94.83
		SD	14.34	11.67	14.35	13.27	8.60	12.48
9	25	M	101.68	105.00	107.75	102.56	103.40	101.84
		SD	9.23	13.74	7.02	12.10	9.95	11.12
10	11	M	94.45	97.73	99.56	96.55	97.91	94.09
		SD	7.87	6.13	3.13	5.15	8.03	5.49
11	14	M	95.07	95.36	94.92	93.07	94.29	92.64
		SD	9.16	7.61	8.40	6.68	9.51	8.05
12	31	M	97.90	101.61	99.45	97.19	100.45	97.58
		SD	8.00	9.56	8.12	8.55	7.65	7.24
13	101	M	105.75	107.41	107.75	106.52	106.74	106.38
		SD	8.30	10.97	10.34	10.56	10.87	9.08

Table 49, Continued

Cluster Number	N	Math	Read. Rec.	Read. Comp.	Spel.	Gen. Inf.	Total
Total	M	100.55	103.30	104.09	101.39	101.81	100.65
N = 386	SD	9.86	11.57	9.92	11.33	11.02	10.40
	F	9.03	4.99	4.83	5.95	6.71	9.29
	p	.0001	.0001	.0001	.0001	.0001	.0001
14**	M	98.00	101.00	100.00	95.50	103.50	98.00
N = 2	SD	2.82	14.14	5.65	.71	12.02	8.49

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* 26 of the first grade sample did not receive the Reading Comprehension subtest.

** Outlying cluster not included in ANOVA analyses.

Table 50

ANOVA for SCREEN Clusters with the WISC and VMI (First Grade)

Cluster Number	N*		WISC					
			Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
1	21	M	10.43	11.43	9.86	9.48	51.57	78.48
		SD	2.18	3.12	2.50	1.81	8.01	8.93
2	7	M	13.14	13.57	11.57	11.14	61.86	79.43
		SD	2.04	2.70	1.90	3.24	8.47	11.70
3	9	M	9.50	12.44	8.89	9.56	52.13	80.89
		SD	3.78	3.09	2.47	1.59	8.95	8.31
4	80	M	10.06	11.68	10.29	10.26	52.71	85.54
		SD	3.76	3.41	2.91	2.28	10.38	18.09
5	24	M	10.63	12.04	9.67	9.25	51.58	74.58
		SD	3.20	3.20	3.42	2.11	10.34	14.46
6	6	M	7.20	10.00	7.80	7.80	41.60	70.00
		SD	4.92	6.04	4.38	2.28	19.35	4.15
7	45	M	9.47	10.56	8.89	9.56	48.44	76.29
		SD	3.04	2.95	2.85	2.70	11.39	12.59
8	12	M	10.00	12.67	8.58	9.67	50.42	85.25
		SD	2.34	3.70	2.84	2.87	10.43	14.32
9	25	M	10.92	10.88	10.00	9.88	52.56	84.60
		SD	2.80	2.70	2.66	3.17	10.80	14.19
10	11	M	9.90	8.73	8.00	7.40	41.67	75.73
		SD	2.73	3.90	1.73	2.01	6.63	12.13
11	14	M	10.14	11.36	8.57	8.57	48.50	80.07
		SD	2.88	3.52	3.67	1.91	12.77	8.98
12	31	M	10.97	12.74	10.42	9.90	54.81	79.74
		SD	3.34	2.83	1.71	2.09	8.54	15.82
13	101	M	10.36	11.79	10.53	10.72	54.05	88.36
		SD	3.24	3.67	3.06	2.64	9.94	20.38

Table 50, Continued

Cluster Number N		WISC Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
Total	M	10.26	11.58	9.92	9.95	52.10	82.66
N = 386	SD	3.26	3.42	2.93	2.54	10.61	16.84
	F	1.39	1.93	2.39	3.02	2.87	3.07
	p	NS	.03	.006	.0001	.001	.0001
14**	M	6.50	8.50	7.50	9.00	39.50	70.50
N = 2	SD	3.54	3.54	.71	1.41	12.02	4.95

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* Those subjects with various subtests missing are not included in the analyses (N = 6).

** Outlying cluster not included in ANOVA analyses.

Table 51

ANOVA for SCREEN Clusters with the Phonetics Test and Age (First Grade)

Cluster Number	N		Phonetics Test Init. Cons.	L & S Vowels	Final Cons.	Cons. Blends	Total	Age
1	21	M	.90	4.29	1.62	3.00	9.81	85.81
		SD	1.89	2.22	2.25	2.12	6.87	4.05
2	7	M	.00	2.00	.14	.43	2.57	85.14
		SD	.00	1.83	.38	.79	2.23	3.24
3	9	M	.11	1.33	.11	.78	2.33	86.33
		SD	.33	1.58	.33	.97	1.94	4.06
4	80	M	.20	2.29	.70	.96	4.15	86.93
		SD	.43	2.03	1.49	1.73	4.36	4.63
5	24	M	.50	3.17	1.25	1.42	6.33	86.[illegible]3
		SD	1.44	2.26	1.89	1.67	6.07	3.84
6	6	M	2.67	6.33	4.33	5.67	19.00	86.33
		SD	2.88	3.61	3.33	3.44	12.28	4.50
7	45	M	.73	3.64	1.09	2.13	7.60	87.07
		SD	1.66	2.39	1.79	2.50	6.50	4.91
8	12	M	1.00	3.58	1.67	2.25	8.50	88.42
		SD	1.86	2.57	2.87	2.56	8.71	8.52
9	25	M	.44	2.96	.96	1.28	5.64	86.00
		SD	1.29	2.82	1.95	2.09	6.54	4.06
10	11	M	.36	4.73	2.18	3.82	11.09	85.91
		SD	.50	2.68	2.27	2.44	6.83	3.75
11	14	M	.71	4.29	2.29	3.21	10.50	88.14
		SD	1.59	2.16	2.70	2.91	7.46	4.90
12	31	M	.26	3.10	.74	1.81	5.90	86.58
		SD	.63	2.37	1.69	2.27	5.65	3.36
13	101	M	.15	2.16	.44	.52	3.28	87.46
		SD	.58	1.71	.84	1.34	3.23	4.03

Table 51, Continued

N		Phonetics Test Init. Cons.	L & S Vowels	Final Cons.	Cons. Blends	Total	Age
Total	M	.41	2.90	.94	1.47	5.73	86.92
N = 386	SD	1.16	2.32	1.78	2.18	6.10	4.41
	F	4.00	5.69	5.16	9.04	9.25	.72
	p	.0001	.0001	.0001	.0001	.0001	NS
14*	M	.00	5.00	.50	1.50	7.00	93.50
N = 2	SD	.00	1.41	.71	.71	2.82	2.12

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* Outlying cluster not included in ANOVA analyses.

the lowest performing group on the ITPA (Mean PLQ = 89) and on the PIAT Total (M-%tile = 25th). In addition, this SCREEN performance cluster corresponds to significant below average performance on all of the Phonetics subtests but with scores in the average intelligence range.

Figure 20 (Cluster 7) contains 45 subjects representing 11.6% of the total first grade sample who have a major deficit on the Basic Knowledge subtest and as a group has minor problems on the Visual Skills, Auditory Skills, Figure Copying, and teacher ratings of Cognitive-Perceptual Skills according to the SCREEN test profile. This profile corresponds to significant below average performance on the Visual Association subtest of the ITPA (M-S.S. = 32), on the Math subtest of the PIAT (M-%tile = 34th) with the total group having an average Verbal IQ.

Figure 21 (Cluster 10) is representative of 11 children who have significant deviant performance on the Auditory Skills, teacher ratings of Cognitive-Perceptual Skills, Social Adjustment, and Immaturity subtests of the SCREEN battery. Correspondingly, there is significant below average performance on the Math subtest of the PIAT (M-%tile = 34th) and on three of the Phonetics subtests.

Figure 22 (Cluster 11) contains 14 subjects represeenting 3.6% of the total first grade sample. The SCREEN performance profile indicates that the teachers rate the children in this cluster as having significant Cognitive-Perceptual Skills, Social Adjustment, and Immaturity problems. This cluster grouping corresponds to significant below average performance on the Grammatic Closure subtest of the ITPA, on the Math, Reading, Comprehension, and Total PIAT subtests (95% confidence interval ranging from the 19th percentile to the 49th percentile).

Figure 23 (Cluster 14) represents two subjects who form an outlying cluster group in the first grade sample. The SCREEN test performance profile indicates substantial "high risk" in Self Concept and School Adjustment and Visual Skills with superior performance on the Auditory Skills and Basic Knowledge subtests. A closer examination of the individual scores reveals that there is considerable variance on the Self Concept and School Adjustment subtest (Range = 38 to 126). However, both subjects have significant Visual Skills problems. These two subjects have both significant below and above average performance on various diagnostic tests. However, both subjects perform at approximately one standard deviation below the mean on the Vocabulary subtest of the WISC and have a Verbal IQ ranging from 76 to 97. These relatively low vocabulary skills have probably contributed to the poor performance on the Visual Skills subtest of the SCREEN battery.

Figure 24 (Cluster 8) contains only male children who have significant Self Concept and School Adjustment deficits with "high risk" teacher ratings in Behavioral Adjustment and Cognitive-Perceptual Skills. This first grade profile corresponds to both below and above average performance on the Math subtest of the PIAT (M-%tile = 40th; 95% Conf. Int. = 24th to 64th). These boys, 92% from regular classes, score in the average range on all the other diagnostic tests.

Figure 25 (Cluster 2) represents seven subjects who perform significantly above average on the various diagnostic subtests, although they have been rated by teachers to have significant Behavioral Adjustment and Immaturity deficits on the SCREEN battery profile. For example, the mean ITPA performance on the PLQ total score (Mean = 113) is at the 81st percentile and the Total PIAT score (Mean = 108) is at the 71st percentile. This cluster is similar to the teacher rating profiles in the kindergarten sample, Figure 11 and Figure 17.

Figure 26 (Cluster 9) contains 25 children, 84% boys, who have significant above average performance only on the PIAT Reading Comprehension subtest. Although these subjects report that they have relatively poor self concepts on the SCREEN battery, the other child skill tests and teacher ratings are in the average range with corresponding average performance on the vast majority of the diagnostic tests.

Figure 27 (Cluster 13) contains 101 subjects representing 26.0% of the total first grade sample who have average or above average performance on all of the SCREEN test performance subtests. Accordingly, this major cluster of children has significant above average performance on the total ITPA (Mean PLQ = 109) and on the Math, Reading Comprehension, and Total PIAT subtests.

Figure 28 through Figure 23 illustrate the remaining SCREEN performance clusters that have no corresponding significant above average or below average performance on the diagnostic tests. Figure 28, Figure 29, and Figure 30 represent clusters of children, the majority of whom are boys, who have teacher rating deficits of Cognitive-Perceptual Skills, Behavioral Adjustment, and Social Adjustment, respectively. Figure 31 (Cluster 12) contains 31 children, 55% girls, who have been rated by the teacher as having significant Immaturity problems, with some children rated as having deficits on the Cognitive-Perceptual Skills, Behavioral Adjustment, and Social Adjustment teacher ratings.

One should note that these teacher rating performance profiles, children rated to have Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment, or Immaturity problems by the teacher, without corresponding significant above or below average performance on the diagnostic tests have counterpart clusters in the kindergarten sample. Figure 32 (Cluster 4) contains 80 subjects representing 20.6% of the total first grade sample who have average performance on the SCREEN subtests with corresponding average performance on all the diagnostic tests.

Discussion: Cluster Analysis on the SCREEN Early Identification Battery

The utility of the cluster analysis procedure in identifying relatively homogeneous performance profiles which have educational predictive utility has been demonstrated in the present study. One can generally state that when any one or combination of the SCREEN child skill tests, including Visual Skills, Auditory Skills, Figure Copying, and Basic Knowledge, are in the "high risk" range, there is close to a 100% probability of these children having significant below average performance on a variety of educational diagnostic instruments. When teacher ratings of Cognitive-Perceptual Skills are in agreement with a "high risk" child skill test profile, there is a correspondingly high probability that such children will have even more severe deficits according to the individual diagnostic assessment. On the other hand, when the SCREEN battery profile is in the superior range, one can accurately predict that such children will score significantly above average on a variety of educational assessment instruments.

In the kindergarten sample, there were seven "high risk" SCREEN clusters which were differentially related to below average performance on the various diagnostic measures. These deficit profiles in kindergarten consisted of 116 children or 30.85% of the total kindergarten sample. The six "high risk" profiles in the first grade sample, four of which were replicated from the kindergarten cluster study, contained 90 children or 23.20% of the total first grade sample. In essence, there is a total of nine homogeneous SCREEN profiles which are highly related to significant below average academic skills as assessed through individual diagnostic services. This knowledge can provide enormous efficacy in identifying those children in the early school grades who have a high potential for serious academic problems prior to jeopardizing the child's school career. To place these data in a clearer perspective, the "high risk" profiles in the present study make up 6.6% of the total kindergarten population which received screening services in 1974, and the first grade deficit profiles account for 5.1% of their original total sample. These percentages are slightly conservative since not all the children scoring in the "high risk" ranges on the SCREEN battery received individual diagnostic assessments, due to parental permission requirements, summer vacations, and school transfers. It would not be unreasonable to expect school systems to provide follow-up services for approximately 7% of their kindergarten or first grade population, since the referral could be cost effective in limiting unnecessary diagnostic assessments. No child should be labeled or otherwise categorized through screening. The early identification process represents an entry into an individually oriented service network, which may provide extra-educational help for those children who are most in need. Such assistance may come through teachers who are more informed about the child's educational strengths and weaknesses and/or special education placements.

The present study was designed such that two-thirds of the sample would be considered "high risk" based upon all nine of the SCREEN subtests and/or teacher referrals, while the remaining third of the sample constituted a control group, selected randomly from the children who were neither teacher nor SCREEN referred. If one utilizes the original conservative 4th percentile or lower criteria as basis for the SCREEN Referral category, there is a 81% hit rate in kindergarten and a 99% hit rate in first grade referral of those children in the "high risk" cluster groups. In comparison, teacher referral "hits" are 70% for the kindergarten sample and 66% for the first grade sample. Teachers were able to refer twelve children who were not accurately referred by SCREEN. Of course, utilizing a higher percentile, e.g., one standard deviation, or the actual "high risk" profile would permit the SCREEN referral to reach extremely close to 100% accuracy in predicting those children that have a high potential for below average academic performance.

In general, the Teacher Referred, SCREEN Referred, Common Referral, and Comparison Group subsamples which were previously generated for experimental purposes do not represent useful correlates for the SCREEN derived clusters. The major potential of the first three categories was realized in selecting a sample that would increase the probability of finding patterns of relatively low frequency SCREEN deficit profiles. Translated into practical terms, there is less than a 50-50 chance that one child in a typical classroom would have the most frequent "high risk" profile which was significantly related to poor academic performance. A major problem with the above categories was in the large number of teacher over and under referrals based on the ratings of Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment, and Immaturity. It should be noted that teachers have a relatively good idea about the intellectual abilities of some of their students. However, teacher judgment is often clouded by other factors which can lead to serious mistakes in evaluating the academic aptitude of some students. There is little efficacy in relying solely on teacher ratings as a referral system in the schools. Children who are immature, have poor social skills, and who exhibit a variety of behavior problems typically annoy the teacher causing an underestimate of their educational capabilities. Also, there is a tendency to over-estimate intellectual abilities of children who are socially skillful, cooperative, or mature for their age. The vast majority of the children who received poor teacher ratings were boys, perceived as behavior problems but who had average or above average performance on all the diagnostic measures.

Teacher ratings have their best utility in predicting educational deficits only when used in combination with other objective child skill tests. Detailed examination of the various clusters allows one to select those SCREEN variables and performance profiles which are most indicative of above and below average performance in a variety of school skill areas. These "high risk" patterns are relatively low frequency events which could not be isolated through correlational procedures as such infrequent groupings would be lost to error variance in correlating across a wide range of the population. SCREEN profiles and variables which are most related to significant deficits in psycholinguistic, achievement, and varying degrees of verbal intelligence skills have been isolated. Primarily, various combinations of the child skill tests and teacher ratings of Cognitive-Perceptual Skills make up the SCREEN variables which have utility in predicting school success or school failure. However, one would not discard these SCREEN subtests as part of an early identification battery simply because in isolation they do not significantly relate to academic achievement. The diagnostic variables used in the present study only represent a small subset of possible correlates that could be examined. Structured teacher ratings integrated with the child performance information can serve to provide a more comprehensive description of each child's in-class behaviors. Such an early identification system aids diagnosticians by focusing follow-up diagnostic assessment when needed and eliminates unnecessary referrals. Diagnosticians often feel that they have an impossible hypothesis solving task when a child is referred for general individual assessment. Administratively, a screening system where teacher and diagnostician efforts are targeted limits the basic large follow-up battery to more specific questions which can be examined in greater detail within the same time frame, thereby making diagnosis more cost effective. For example, the diagnostic question for a child rated as having only Cognitive-Perceptual Skill and Behavioral Adjustment problems with average or superior performance in child tested skill areas differs dramatically from the follow-up hypothesis concerning the child with "high risk" skill areas and concurrent Behavioral Adjustment problems as observed by the teacher. In the first case, the school diagnostician could concentrate assessment questions on personality dimensions, peer relations, or poor family relations. The follow-up diagnosis for the child in the second example could be centered on more academic related questions. With the current mandate to provide screening, identification of all children who may be in need of special education services, administrators need to recognize that group data can be highly efficacious when tied to sound emperical correlates. Evidence from the present study clearly demonstrates that "down and dirty" teacher referral or checklist systems do little good in accurately identifying children who have the potential for school failure in the early school grades.

In summary, there is a variety of relatively homogeneous SCREEN performance profiles which accurately predict below or above average educational performance at the end of kindergarten and first grade according to individual diagnostic follow-up. These "high risk" performance groups were not significantly related to age. That is, younger children in kindergarten and first grade were not found to have a greater potential for early school failure, although teachers tend to misrefer children who are perceived as beihg immature. When groups of children are combined through cluster analytic procedures based on relatively homogeneous SCREEN performance, the diagnostic and predictive utility is greatly enhanced. These target profiles can be utilized in future research by isolating groups of individuals from the large population who have common performance features which place them at "high risk" for academic failure in school. To my knowledge, no other screening battery has demonstrated such a high degree of reliability and validity.in predicting early school success or failure. The ethics and psychometrics of test development dictate that no assessment procedure should be considered totally reliable and valid. Therefore, this study does not represent an end point in developing a more highly reliable and valid screening procedure, but rather a beginning in being able to isolate common clusters of learning problem children. Future research needs will be discussed below, addressing the point that it is these learning problem groups that need to be studied if there is to be efficacy in refining early identification procedures, in increasing the validity and utility of diagnosis, in planning various treatment programs, in conducting differential remediation research, and in developing an educational classification system which has empirically based correlates.

Results: ITPA Cluster and ANOVA Analyses for Kindergarten

In the kindergarten sample there were 19 relatively homogeneous clusters ranging in size from one subject to 64, including three outlying clusters. This represents a reduction from 376 possible unique clusters by over 95%. Of these 19 clusters, seven contained homogeneous groups of children who had significant below average performance on the subtests of the PIAT, WISC, or Phonetics Test. There were four clusters which significantly predicted above average performance on the diagnostic measures. One should note that there are several clusters with significant above and below average performance on diagnostic measures indicating various patterns of strengths and weaknesses in academic performance. Results of the analysis of variance for kindergarten are presented in Table 52 through Table 54 for each criterion variable by cluster

Table 52

ANOVA for ITPA Clusters with the PIAT*
(Kindergarten)

Cluster Number	N		Math	Read. Rec.	Spel.	Gen. Inf.	Total
1	9	M	100.44	99.78	99.44	97.33	97.67
		SD	9.23	7.56	9.17	8.63	6.89
2	31	M	95.87	100.61	98.87	99.10	97.00
		SD	7.17	6.42	7.68	8.84	6.28
3	11	M	94.09	94.91	96.27	96.00	92.09
		SD	10.18	8.83	6.86	6.31	7.34
4	25	M	96.32	100.56	98.40	97.40	95.96
		SD	6.85	6.40	6.53	9.57	6.31
5	15	M	93.47	95.73	94.13	95.27	91.53
		SD	7.80	8.39	4.56	8.89	6.30
8	19	M	94.47	99.42	100.26	102.32	97.53
		SD	8.75	6.63	7.16	6.07	6.94
10	19	M	100.26	104.05	101.84	99.42	100.37
		SD	8.79	7.33	7.23	7.60	6.22
11	16	M	101.56	104.94	103.31	101.31	100.94
		SD	6.09	6.05	6.55	9.44	5.58
12	24	M	106.67	107.33	106.71	105.46	105.96
		SD	9.25	9.84	8.87	7.39	7.56
13	12	M	98.50	107.25	106.00	103.25	102.58
		SD	8.93	11.40	9.25	9.38	6.97
14	36	M	102.47	101.81	101.33	104.33	100.81
		SD	8.72	7.38	7.93	7.73	6.92
15	12	M	89.25	96.67	92.25	87.67	88.92
		SD	10.21	7.94	9.58	10.20	10.03
16	20	M	89.89	93.05	93.89	93.32	88.79
		SD	9.72	9.25	7.89	10.42	8.88
17	25	M	93.24	93.52	95.52	92.60	89.96
		SD	7.45	8.82	8.81	11.40	7.14

Table 52, Continued

Cluster Number	N		Math	Read. Rec.	Spel.	Gen. Inf.	Total
18	64	M	108.41	112.23	110.09	108.17	109.67
		SD	10.15	10.97	10.02	7.56	9.32
19	30	M	107.80	111.83	110.13	114.10	111.13
		SD	6.77	9.64	8.36	6.97	7.08
Total N = 368		M	100.16	103.24	102.16	101.73	100.29
		SD	10.55	10.72	9.98	10.56	10.39
		F	13.14	13.47	12.08	14.47	23.17
		p	.0001	.0001	.0001	.0001	.0001
6** N = 1		M	81.00	84.00	82.00	74.00	75.00
		SD	--	--	--	--	--
7** N = 3		M	95.67	109.33	106.67	103.00	104.00
		SD	6.02	10.02	5.51	10.44	6.08
9** N = 4		M	99.75	106.00	106.25	99.00	102.00
		SD	9.64	6.98	6.70	17.98	9.56

* The majority of the kindergarten sample did not receive the Reading Comprehension subtest.

** Outlying cluster not included in ANOVA analyses.

Table 53

ANOVA for ITPA Clusters with the WISC and VMI (Kindergarten)

Cluster Number	N*		WISC Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
1	9	M	11.33	10.22	10.33	8.22	50.33	70.78
		SD	2.87	2.82	2.12	2.68	9.64	6.74
2	31	M	10.52	10.42	8.71	10.06	50.13	68.87
		SD	3.58	3.72	3.25	1.97	8.86	10.30
3	11	M	9.55	8.55	7.18	9.27	43.36	68.45
		SD	1.29	2.62	2.48	2.15	5.01	10.01
4	25	M	10.36	10.60	9.12	9.76	49.84	66.80
		SD	2.96	3.05	3.44	2.60	9.53	4.63
5	15	M	8.53	7.87	6.87	8.60	39.80	64.67
		SD	2.17	3.40	3.16	2.69	11.23	5.15
8	19	M	11.00	11.53	9.47	10.42	52.95	72.89
		SD	2.43	3.63	2.52	2.24	7.95	9.75
10	19	M	9.71	10.58	9.11	9.26	47.76	74.89
		SD	3.42	3.49	3.57	2.16	11.52	14.43
11	16	M	10.31	10.44	9.69	10.63	51.56	72.38
		SD	3.36	3.86	2.24	1.89	8.48	7.98
12	24	M	9.70	12.04	10.92	10.46	53.61	78.50
		SD	4.22	3.34	2.64	2.47	9.34	13.35
13	12	M	11.73	10.64	10.36	10.82	54.64	73.75
		SD	1.90	2.94	2.38	2.09	7.23	12.11
14	36	M	11.61	11.67	10.67	9.61	54.47	72.33
		SD	2.59	2.72	2.67	2.03	7.77	11.38
15	12	M	6.17	7.25	7.25	7.58	35.42	68.92
		SD	2.48	1.82	3.11	1.98	6.13	10.24
16	20	M	7.65	8.90	7.65	6.60	38.65	66.30
		SD	2.68	2.63	1.79	2.09	7.46	7.80
17	25	M	9.42	9.52	8.08	7.48	43.09	67.88
		SD	3.03	3.07	2.04	2.14	8.42	9.13

Table 53, Continued

Cluster Number	N		WISC Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
18	64	M	11.49	12.73	11.06	11.55	58.76	75.69
		SD	3.68	3.60	3.08	2.84	11.29	11.80
19	30	M	12.38	13.77	11.77	11.90	62.45	73.93
		SD	2.46	2.78	3.04	2.72	10.13	9.80
Total		M	10.43	11.00	9.66	9.88	51.30	71.78
N = 368		SD	3.35	3.57	3.15	2.77	11.63	10.86
		F	5.21	6.57	6.38	9.60	14.18	3.29
		p	.0001	.0001	.0001	.0001	.0001	.0001
6**		M	7.00	5.00	4.00	6.00	28.00	67.00
N = 1		SD	--	--	--	--	--	--
7**		M	10.00	11.33	12.00	13.00	58.00	75.33
N = 3		SD	2.65	3.51	2.65	2.65	3.00	5.77
9**		M	6.50	8.50	7.00	8.00	37.50	69.00
N = 4		SD	3.11	4.[illegible]	.82	2.83	9.27	6.93

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* Those subjects with various subtests missing are not included in the analyses (N = 7).

** Outlying cluster not included in ANOVA analyses.

Table 54

ANOVA for ITPA Clusters with the Phonetics Test and Age (Kindergarten)

Cluster Number	N*		Phonetics Test Init. Cons.	L & S Vowels	Final Cons.	Cons. Blends	Total	Age
1	9	M	3.78	6.56	6.11	6.33	22.78	76.78
		SD	2.49	1.81	1.76	1.94	5.80	6.16
2	31	M	4.00	6.41	5.79	5.64	21.83	75.16
		SD	3.21	2.06	2.92	2.53	9.66	4.13
3	11	M	4.55	7.18	6.27	5.73	23.73	75.36
		SD	3.33	1.60	2.24	2.15	8.24	4.30
4	25	M	3.39	6.19	4.90	5.81	19.81	74.28
		SD	3.26	2.32	3.16	3.03	9.04	3.13
5	15	M	5.23	7.17	7.31	6.82	25.91	75.67
		SD	2.59	1.19	1.55	1.94	5.58	4.70
8	19	M	2.89	6.67	3.71	4.94	17.81	75.16
		SD	2.98	1.72	2.82	2.93	8.63	3.17
10	19	M	2.37	5.68	3.89	5.63	17.58	75.21
		SD	2.65	2.16	2.73	2.34	7.66	3.47
11	16	M	1.31	6.19	4.31	4.60	16.20	74.50
		SD	2.47	1.60	3.30	3.00	7.86	3.16
12	24	M	1.00	4.96	2.75	4.00	13.04	74.50
		SD	1.72	2.55	3.15	3.11	8.75	4.13
13	12	M	3.92	6.10	4.80	5.78	20.78	72.75
		SD	3.26	1.73	2.70	3.03	10.17	3.55
14	36	M	2.91	6.21	5.29	6.06	20.41	75.00
		SD	2.79	2.09	2.97	2.84	8.90	3.77
15	12	M	4.70	6.63	5.13	6.00	22.38	76.67
		SD	3.62	1.89	3.31	2.62	9.52	3.42
16	20	M	6.17	7.06	7.00	7.31	27.75	76.35
		SD	2.36	1.48	1.50	1.35	5.14	4.94
17	25	M	5.13	7.05	6.92	6.83	26.27	74.60
		SD	3.19	1.29	1.79	1.63	5.96	3.77

Table 54, Continued

Cluster Number	N		Phonetics Test					
			Init. Cons.	L & S Vowels	Final Cons.	Cons. Blends	Total	Age
18	64	M	.92	4.48	2.14	2.87	10.11	73.50
		SD	1.74	2.52	2.64	2.51	7.38	2.80
19	30	M	.47	5.07	1.37	2.33	9.23	73.70
		SD	.90	2.35	2.03	2.09	5.59	3.37
Total		M	2.79	5.89	4.32	4.92	17.69	74.67
N = 368		SD	3.05	2.24	3.19	2.92	9.72	3.78
		F	10.68	4.48	11.56	8.71	12.94	1.69
		p	.0001	.0001	.0001	.0001	.0001	.05
6**		M	7.00					83.00
N = 1		SD	--					--
7**		M	1.33	7.67	4.33	6.00	19.33	73.33
N = 3		SD	1.53	1.15	3.79	2.00	5.51	4.04
9**		M	3.00	6.50	3.50	4.50	17.50	74.75
N = 4		SD	3.37	1.73	3.70	3.70	11.45	4.43

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* Those subjects with various subtests missing are not included in the analyses (N = 12).

** Outlying cluster not included in ANOVA analyses.

designation. All the F ratios for each criterion variable were significant. However, only those criterion variables which had significant contrast results are indicated on each ITPA mean profile cluster. The mean ITPA profiles which were derived from each cluster are presented in Appendix F (Figure 33 through Figure 51). The Chi-square for both sex and class placement by ITPA cluster designation for both the kindergarten and first grade samples were not significant. There were no significant age contrast comparisons for the kindergarten sample across cluster groups.

Figure 33 (Cluster 3) contains 11 subjects who perform at approximately one standard deviation below the norm mean (Scaled Score = 36, SD = 6) on the Visual Closure subtest of the ITPA, with this corresponding to significant below average performance on both Reading Recognition and the Total PIAT scores. These children with average intelligence also have significant below average performance on the various Phonetics subtests.

Figure 34 (Cluster 5) contains 15 subjects representing 4% of the total kindergarten sample who perform one standard deviation or more below norm on the Visual Closure and Auditory Closure subtests of the ITPA. Subjects in this cluster have a mean Verbal IQ of 87 (97.5% ranging from 80 to 95) with significant below average performance on five of the PIAT subscores, the VMI, and all of the Phonetics subtests.

Figure 35 (Cluster 15) represents the mean ITPA performance profile for 12 subjects who have significant below average performance on the PIAT, WISC, and Phonetics Test. The children in this cluster have significant Visual Reception, Visual Closure, and Visual Sequential

Memory strengths with a standard deviation below the mean norm performance on Auditory Reception, Auditory Association, Grammatic Closure, Auditory Closure, and Sound Blending subtests of the ITPA. This cluster represents a group of children who are in one of the lower IQ groups with a mean Verbal IQ of 81, 97.5% ranging between a 77 IQ and 86 IQ. Half of these subjects also perform more than a standard deviation below the mean of the Math, Spelling, and Total PIAT scores and on the Comprehension and Similarities subtests of the WISC.

Figure 36 (Cluster 16) contains 20 subjects, 75% of whom are males. This group of children have significant below average performance at a standard deviation or more below norm on the Auditory Reception, Auditory Association, Grammatic Closure, and Auditory Sequential Memory subtests of the ITPA with corresponding strengths in the Visual Association, Manual Expression, and Visual Closure subtests. This is a group of children with an average Verbal IQ of 86, below average performance on all of the PIAT subtests and on various Phonetics subtests. The mean of the Digit Span subtest of the WISC is a standard deviation below the norm and the mean Verbal IQ for the group is 86 (97.5% ranging from 81 to 90 IQ).

Figure 37 (Cluster 17) contains 25 subjects representing 6.6% of the total kindergarten sample, 72% of whom are males. For this mean ITPA performance profile, none of the deficit subtests are a standard deviation or more below the norm mean. However, there are significant intragroup strengths and weaknesses. There is below average performance on the Auditory Association, Auditory Sequential Memory, and Auditory Closure subtests of the ITPA with significant strengths in Manual

Expression, and Visual Closure. This performance pattern corresponds to significant below average performance on the Vocabulary and Digit Span subtests of the WISC, all of the PIAT and Phonetics measures.

The mean performance profile for one subject shown in Figure 38 (Outlying Cluster 6) is more than two standard deviations below the norm mean for the ITPA scores. However, the intra-individual differences on the various subtests indicate significant weaknesses in the Verbal and Manual Expression and Auditory Closure subtests. This child performs more than one standard deviation below the mean on all the diagnostic subtests and has a Verbal IQ of 72.

The three male subjects in Figure 39 (Outlying Cluster 7) have an ITPA performance pattern which is indicative of extremely high Auditory strengths and relatively low Visual Reception, Visual Closure, and Visual Sequential Memory deficits. These children have above average IQ's ranging from a Verbal IQ of 106 to 114 with no significant below average performance on the achievement or phonetics diagnostic tests. Apparently, the extremely high auditory skills and above average intelligence are sufficient to compensate for any visual deficits which may be indicated. With such high compensating scores the PLQ is actually in the average range (Mean PLQ = 104).

The four subjects shown in Figure 40 (Outlying Cluster 9), one female and three males, perform 2½ standard deviations below the norm mean on the Auditory Association and one standard deviation below norm on the Visual Sequential Memory subtest of the ITPA, and 2½ standard deviations above the mean on the Sound Blending subtest with all other scores being in the average range. In correspondence, these children perform significantly below the mean on the Similarities, Vocabularly, and Digit Span subtests of the WISC, having an average IQ of 84, 97.5% ranging from 67 to 94. These children have a sufficient number of average ITPA strengths, such that they perform above average on the Reading Recognition and Spelling subtests of the PIAT and in the average range on the other achievement and diagnostic measures.

Figure 41 (Cluster 12) contains 24 subjects representing 6.4% of the total kindergarten sample who have an average intelligence and perform significantly above the mean on the Math and Total PIAT scores, with significant above average performance on the VMI and various Phonetics subtests. The overall ITPA performance profile for this cluster is elevated averaging approximately one standard deviation above the norm mean for the majority of the ITPA subtests with significant strengths indicated in the Visual Association and Grammatic Closure subtests. Similarly, the 64 subjects in Figure 42 (Cluster 18) have an elevated ITPA performance profile with corresponding above average intelligence skills on the WISC (mean Verbal IQ = 111, 97.5% ranging between 108 and 115). In correspondence, these children performed significantly above average on all of the PIAT subtests and on the Phonetics subtests.

The 30 subjects illustrated in Figure 43 (Cluster 19) also have extremely elevated mean ITPA performance profiles at more than a standard deviation above the norm. Performance on all of the PIAT, WISC, and Phonetics subtests is also significantly above the mean with this group having an average Verbal IQ of 115, 97.5% of whom range between a 111 Verbal IQ to 120 Verbal IQ.

The eight remaining ITPA clusters (Figure 44 through Figure 51) for the kindergarten sample are representative of children who have average performance on the ITPA in general with corresponding average performance on all of the diagnostic tests. Specifically, there are no significant below or above average achievement scores, intelligence scores, or Phonetics Test scores for these performance profiles.

Results: ITPA Cluster and ANOVA Analyses for First Grade

The cluster analysis for the ITPA first grade sample yielded 24 relatively homogeneous clusters, including six outlying clusters with relatively small N's. These 24 homogeneous groups represent a 93.8% reduction from a possible 388 unique performance profiles. Of these 24 clusters, eight corresponded to below average performance on various diagnostic tests and the six outlying clusters significantly related to above or below average performance on the various diagnostic tests. There were four clusters that had significant above average performance on the diagnostic measures. The results of the analysis of variance for the ITPA clusters with the diagnostic measures are contained in Table 55 through Table 57 with all of the F ratios being significant for every diagnostic criterion measure. The Chi-square for the sex and class placement variables were not significant across the cluster designations in the first grade sample. However, one should note that the contrast comparisons for the age variable were significant for four clusters; these below and above age groupings will be indicated in each cluster figure.

Table 55

ANOVA for ITPA Clusters with the PIAT (First Grade)

Cluster Number	N		Math	Read. Rec.	Read. Comp.*	Spel.	Gen. Inf.	Total
1	39	M	98.77	101.62	103.22	100.00	98.38	99.05
		SD	6.17	9.13	7.76	9.71	9.54	7.03
2	15	M	98.13	105.13	102.60	100.80	97.40	99.87
		SD	11.21	9.16	6.51	7.89	11.10	7.15
3	9	M	100.22	102.22	100.44	98.67	97.56	97.89
		SD	7.36	7.98	8.20	10.92	5.34	6.94
5	8	M	103.75	98.63	100.50	97.75	102.88	99.63
		SD	6.06	7.73	6.97	6.20	8.01	4.00
6	59	M	104.88	107.20	108.19	105.00	108.34	106.05
		SD	6.96	10.76	9.35	9.02	9.48	8.18
7	9	M	101.67	96.78	98.63	99.56	102.33	97.67
		SD	10.10	5.26	4.03	4.50	6.95	5.05
8	19	M	98.00	100.53	102.00	99.58	101.26	98.47
		SD	6.19	12.78	9.88	10.93	11.45	9.42
9	20	M	97.20	98.85	97.83	95.90	99.80	95.40
		SD	7.50	10.19	8.06	8.81	8.14	8.16
10	14	M	99.93	102.71	103.71	101.86	102.79	100.21
		SD	10.61	9.74	9.17	10.38	8.83	9.53
12	12	M	95.67	91.00	94.64	93.17	94.17	91.92
		SD	9.33	8.18	9.87	15.13	8.32	9.35
13	11	M	99.27	100.64	101.82	98.82	100.18	98.55
		SD	8.09	8.61	7.76	9.64	11.25	6.14
17	23	M	98.26	103.47	102.96	102.78	99.48	100.26
		SD	7.17	8.75	7.74	8.97	8.36	6.80
18	20	M	101.20	102.55	102.32	98.00	100.90	98.90
		SD	8.53	11.28	8.65	11.59	7.06	9.65
20	23	M	96.57	99.35	99.35	97.83	96.30	95.96
		SD	7.68	10.68	10.10	11.04	11.62	9.16

Table 55, Continued

Cluster Number	N		Math	Read. Rec.	Read. Comp.	Spel.	Gen. Inf.	Total
22	35	M	91.00	95.11	98.04	94.14	92.63	90.77
		SD	10.48	10.34	9.88	11.48	9.70	10.06
24	64	M	109.81	114.25	112.77	110.73	110.75	111.17
		SD	7.86	9.42	8.27	10.68	9.03	8.80
Total		M	100.85	103.49	104.18	101.53	101.98	100.86
N = 380		SD	9.61	11.50	9.91	11.29	10.91	10.29
		F	11.35	9.83	8.65	6.80	10.01	13.94
		p	.0001	.0001	.0001	.0001	.0001	.0001
11**		M	85.50	89.00	91.00	88.00	97.00	86.50
N = 2		SD	2.12	1.41	.00	1.41	16.97	6.36
15**		M	81.00	107.00	106.00	105.00	86.00	96.00
N = 1		SD	--	--	--	--	--	--
16**		M	89.00	87.00		84.00	99.00	86.00
N = 1		SD	--	--		--	--	--
19**		M	91.00	91.00	95.00	102.00	107.00	96.00
N = 1		SD	--	--	--	--	--	--
21**		M	65.00	80.00		79.00	69.00	74.00
N = 1		SD	--	--		--	--	--
23**		M	95.00	102.50	100.00	100.00	97.50	96.50
N = 2		SD	2.83	16.26	7.07	4.24	10.61	9.19

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* 24 of the first grade sample did not receive the Reading Comprehension subtest.

** Outlying cluster not included in ANOVA analyses.

Table 56

ANOVA for ITPA Clusters with the WISC and VMI
(First Grade)

Cluster Number	N*		WISC					
			Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
1	39	M	10.41	11.41	9.13	9.56	50.82	84.97
		SD	2.38	2.99	1.95	2.07	6.91	19.38
2	15	M	9.53	9.73	8.73	9.60	47.00	76.20
		SD	3.27	3.49	1.71	2.38	8.86	7.47
3	9	M	8.78	12.33	8.78	9.67	49.56	74.00
		SD	1.99	2.35	1.72	1.80	4.42	16.12
5	8	M	9.25	11.63	10.75	11.75	54.13	81.50
		SD	5.01	3.38	2.96	3.96	15.50	16.22
6	59	M	11.61	12.75	11.08	10.69	57.66	88.17
		SD	3.48	3.12	3.06	2.16	9.47	19.21
7	9	M	10.44	12.89	10.89	9.50	54.13	83.89
		SD	2.83	3.44	3.55	1.41	8.24	15.92
8	19	M	9.84	10.95	9.74	8.58	48.58	91.89
		SD	3.53	2.95	2.35	1.57	8.48	20.91
9	20	M	10.25	10.90	9.60	8.80	49.50	77.40
		SD	3.39	2.97	3.15	2.21	10.68	13.95
10	14	M	10.86	11.86	10.29	10.43	54.43	91.14
		SD	2.88	1.96	2.05	1.45	6.61	28.35
12	12	M	9.17	10.25	9.42	8.33	46.67	82.17
		SD	3.35	2.73	1.88	1.15	7.51	8.61
13	11	M	9.64	10.64	9.45	8.36	47.91	82.64
		SD	1.50	2.01	1.97	1.03	3.70	18.05
17	23	M	9.95	10.74	9.74	9.65	50.77	77.04
		SD	3.03	4.10	2.34	1.82	9.53	13.25
18	20	M	9.10	12.35	9.15	9.85	50.70	83.70
		SD	3.32	3.13	3.01	1.46	8.16	15.57
20	23	M	9.39	10.74	9.13	8.87	47.35	79.13
		SD	3.47	3.19	1.96	1.98	9.29	15.92

Table 56, Continued

Cluster Number	N		WISC					
			Comp.	Sim.	Voc.	Digit Span	Verbal IQ	VMI
22	35	M	8.47	8.47	7.38	8.09	40.68	77.40
		SD	2.11	2.67	1.95	2.34	8.46	10.60
24	64	M	11.62	13.59	11.86	12.39	61.53	82.47
		SD	3.30	3.46	3.28	2.64	8.17	14.72
Total		M	10.28	11.59	9.94	9.98	52.17	82.76
N = 380		SD	3.25	3.41	2.89	2.52	10.42	16.92
		F	2.99	5.67	6.22	10.39	12.32	2.07
		p	.0001	.0001	.0001	.0001	.0001	.01
11**		M	7.00	8.00	4.50	8.00	34.50	77.00
N = 2		SD	2.83	4.24	3.54	.00	13.44	7.07
15**		M	9.00	7.00	7.00	9.00	40.00	86.00
N = 1		SD	--	--	--	--	--	--
16**		M	11.00	13.00	12.00	6.00	53.00	63.00
N = 1		SD	--	--	--	--	--	--
19**		M	10.00	8.00	11.00	8.00	46.00	66.00
N = 1		SD	--	--	--	--	--	--
21**		M	1.00	8.00	3.00	4.00	20.00	72.00
N = 1		SD	--	--	--	--	--	--
23**		M	12.00	15.50	11.50	12.00	70.00	78.00
N = 2		SD	2.82	.70	.71	.00	5.65	5.66

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* Those subjects with various subtests missing are not included in the analyses (N = 6).

** Outlying cluster not included in ANOVA analyses.

Table 57

ANOVA for ITPA Clusters with the Phonetics Test and Age (First Grade)

Cluster Number	N*		Phonetics Test					
			Init. Cons.	L & S Vowels	Final Cons.	Cons. Blends	Total	Age
1	39	M	.56	3.15	1.33	1.26	6.31	88.82
		SD	1.65	2.55	1.80	2.16	6.91	4.20
2	15	M	.33	2.60	.60	1.33	4.87	85.27
		SD	.62	1.99	.63	1.59	2.92	2.87
3	9	M	.11	2.67	.44	1.33	4.56	87.33
		SD	.33	1.94	.53	1.66	2.74	3.71
5	8	M	.00	2.25	.38	1.25	3.88	87.00
		SD	.00	1.49	.52	1.28	2.70	3.30
6	59	M	.15	2.31	.54	1.12	4.12	85.47
		SD	.41	1.94	1.18	1.75	4.12	3.73
7	9	M	.78	4.56	1.44	2.89	9.67	87.11
		SD	1.64	2.70	2.01	3.18	6.32	3.98
8	19	M	.74	3.11	1.00	2.53	7.37	89.26
		SD	1.69	2.87	1.97	2.63	7.73	4.78
9	20	M	.60	4.30	1.60	2.35	8.85	87.80
		SD	1.27	2.47	2.33	2.70	7.70	4.40
10	14	M	.43	3.29	.93	1.57	6.21	87.36
		SD	.85	1.77	2.43	2.24	4.44	5.09
12	12	M	.92	4.75	2.75	2.42	10.83	88.33
		SD	1.68	1.96	2.90	2.43	7.94	6.01
13	11	M	.00	3.00	.64	1.73	5.36	85.91
		SD	.00	2.32	1.80	2.53	5.97	3.78
17	23	M	.26	2.43	.96	1.43	5.09	86.22
		SD	.54	1.93	1.74	2.04	4.42	3.66
18	20	M	.60	2.40	.95	1.05	5.00	87.10
		SD	1.47	1.76	2.16	1.50	6.17	3.57
20	23	M	.26	3.04	.78	1.70	5.78	88.43
		SD	.54	2.50	1.89	2.49	5.62	4.21

Table 57, Continued

Cluster Number	N		Phonetics Test Init. Cons.	 L & S Vowels	Final Cons.	Cons. Blends	Total	Age
22	35	M	.94	4.46	1.60	2.66	9.66	88.54
		SD	1.78	2.50	2.29	2.81	7.53	6.25
24	64	M	.02	1.72	.20	.27	2.20	84.86
		SD	.13	1.66	.34	.54	2.03	3.40
Total		M	.38	2.90	.91	1.45	5.64	86.90
N = 380		SD	1.11	2.30	1.72	2.14	5.89	4.43
		F	2.12	4.61	3.01	3.56	5.06	3.31
		p	.009	.0001	.0001	.0001	.0001	.0001
11**		M	.50	2.00	1.00	.50	4.00	93.50
N = 2		SD	.71	1.41	1.41	.71	2.83	2.12
15**		M	1.00	4.00	1.00	2.00	8.00	83.00
N = 1		SD	--	--	--	--	--	--
16**		M	3.00	8.00	6.00	6.00	23.00	87.00
N = 1		SD	--	--	--	--	--	--
19**		M	.00	1.00	1.00	3.00	5.00	88.00
N = 1		SD	--	--	--	--	--	--
21**		M	7.00	9.00	9.00	9.00	34.00	91.00
N = 1		SD	--	--	--	--	--	--
23**		M	.50	1.00	.50	.00	2.00	90.50
N = 2		SD	.71	.00	.71	.00	1.41	2.12

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* Those subjects with various subtests missing are not included in the analyses (N = 8).

** Outlying cluster not included in ANOVA analyses.

The illustrations for the mean ITPA performance profiles derived from the cluster analyses are presented in Appendix G (Figure 52 through Figure 73). The 15 subjects represented in Figure 52 (Cluster 2) are indicative of a group of children who perform one standard deviation below norm on the Auditory Reception subtest of the ITPA and slightly below average on the Auditory Sequential Memory subtest. The Sound Blending subtest is also significantly higher than the mean profile. Such a profile is indicative of children who perform significantly below the mean on the Vocabulary subtest of the WISC. These subjects have Verbal IQ's averaging 96, 97.5% of whom range from an IQ of 90 to an IQ of 101. There are no significant deficits on any of the other diagnostic measures. Apparently, there are a sufficient number of strengths in other skills which compensate for any vocabulary deficit and contribute to average performance on the individual achievement measures.

The mean performance profile for the nine subjects represented in Figure 53 (Cluster 7), 77% of whom are males, is indicative of a profile which has intra-individual strengths and weaknesses. All of the ITPA subtest scores are average or above average with the exception of the Auditory Sequential Memory subtest which is significantly below the overall profile mean of 40 for this ITPA cluster. The children in this profile have a significant strength in Visual Sequential Memory which may correspond to the significant above average performance on the Similarities subtest of the WISC. However, the weakness in the Auditory Sequential Memory subtest of the ITPA may be related to significant below average performance on the two Phonetics subtests and on the total

Phonetics score. The nine children in this profile perform in the average range on all the achievement measures and on the Verbal IQ measure.

The ITPA performance profile which is represented in Figure 54 (Cluster 8) contains 19 subjects who perform in the average range on the PIAT, WISC, and VMI. However, the Verbal Expression and Auditory Closure deficits which are indicated in this profile reflect significant below average performance in several phonetics skills. The overall average ITPA profile for this group of children is sufficient to compensate for any academic achievement deficits.

Figure 55 (Cluster 9) contains 20 subjects who in general have an overall average ITPA performance profile. However, there are significant strengths and weaknesses which are indicated when one examines the individual subtests of the ITPA. For example, the Auditory Reception and Manual Expression subtests are significantly above the Grammatic Closure, Visual Closure, Auditory Sequential Memory, and Auditory Closure subtests of the ITPA. The Auditory Sequential Memory subtest is approximately one standard deviation below the mean for this group. This corresponds to a group of children who have average intelligence but perform significantly below average in Reading Comprehension, Spelling, Total PIAT, and Phonetics tests. This profile has a sufficient number of strengths such that the corresponding deficits in achievement are not severe but are sufficiently below average to cause reading and spelling problems for children who perform in such a manner on the ITPA.

Similar to the latter profile, the 12 subjects who are represented in Figure 56 (Cluster 12) perform on the average at the mean of the ITPA scale. However, there are significant strengths and weaknesses indicated by the pattern of scores with the Visual Reception, Manual Expression, and Visual Closure subtests being significantly above the Auditory Reception, Auditory Association, Visual Association, Verbal Expression, Grammatic Closure, Auditory Sequential Memory, and Auditory Closure subtests. Such a profile is indicative of children who have below average academic achievement performance. The majority of the subjects have relatively minor problems in Math, Reading Comprehension, Spelling, and General Information but have more severe problems in Reading Recognition and on the Digit Span subtest of the WISC. Although these subjects are significantly below average in Verbal IQ (Mean = 95), the range for 97.5% of them (90 IQ to 101 IQ) is of sufficient elevation that children with such a profile may be considered to have a specific learning disability in various academic areas.

Figure 57 (Cluster 13) contains 11 subjects who have average performance on the PIAT, VMI, and Phonetics Tests and in general have average performance on the ITPA subtests with the exception of Auditory Sequential Memory which is 1½ standard deviations below the mean for this performance profile. This corresponds to a significant below average performance only on the Digit Span subtest of the WISC. In general, these children have an average Verbal intelligence.

The 23 subjects who are represented in Figure 58 (Cluster 20) have a mean ITPA performance profile which is a half standard deviation below the norm mean with corresponding strengths in Manual Expression and Sound Blending and deficits in Visual Closure and Visual Sequential Memory subtests of the ITPA. Such a performance pattern is related to a mean Verbal IQ of 96, with these children having below average scores in the areas of Math, General Information, and Total PIAT.

The ITPA performance profile which is illustrated in Figure 59 (Cluster 22) contains 35 subjects who represent 9% of the total first grade population. This performance profile is relatively flat across the ITPA scores and is suppressed approximately half a standard deviation below the norm mean with the Grammatic Closure subtest and Auditory Reception subtests being approximately one standard deviation below the mean. This cluster of children performs on the average significantly below the mean on all the PIAT and WISC subtests. This group of children has a mean Verbal IQ of 89, 97.5% ranging from 85 to 92.

Two subjects are represented in Figure 60 (Outlying Cluster 11) who have significant above and below average performance on the various diagnostic measures. One of the subjects has a Verbal IQ of 69 and the other has a Verbal IQ of 92. This ITPA performance profile is on the average one standard deviation below the norm mean with significant strengths in Auditory Reception, Visual Reception, Auditory Closure, and Sound Blending. Both subjects have significant below average performance on the Math, Reading Recognition, Reading Comprehension, Spelling, and Total PIAT. One of the subjects performs at one standard deviation below the norm mean on the General Information subtest of the PIAT, while the other scores at the 72nd percentile above the mean. Both subjects score a standard deviation below the mean on the Vocabulary subtest of the WISC, while one performs at the 5th percentile and the other at the 63rd percentile on the Similarities subtest. Such a pattern of performance on the WISC probably corresponds to the significant below and above average performance in the General Information category of the PIAT achievement test.

The female child whose ITPA performance profile is illustrated in Figure 61 (Outlying Cluster 15) is indicative of a child who can be said to have a specific learning disability with above and below average performance on the various diagnostic measures. This child has significant above average performance in Reading Recognition, Reading Comprehension, and Spelling subtests of the PIAT and performs more than one standard deviation below the mean on the Math subtest, while having a Verbal IQ of 87. The ITPA performance profile for this subject is indicative of strengths and weaknesses with this child performing more than three standard deviations above the norm mean in the Verbal Expression subtest, two standard deviations above the mean in the Sound Blending subtest, and one standard deviation above the mean on the Visual Closure subtest of the ITPA. Significant deficits are indicated in the Auditory Reception, Auditory Sequential Memory, Auditory Closure, and Visual Association subtests.

Similarly, the male subject whose ITPA performance profile is represented in Figure 62 (Outlying Cluster 16) may be indicative of a specific learning disability profile. The Reception and Association areas of the ITPA are average or above average while there is significant below average performance on the Visual Sequential Memory, Auditory Sequential Memory, Manual Expression, and Sound Blending subtests. Areas of relative strength include the Visual Reception and Grammatic Closure subtests of the ITPA. This child performs significantly above average on the Similarities and Vocabulary subtests of the WISC but scores more than two standard deviations below average on the Digit Span subtest with an average 104 Verbal IQ. This below average performance on the Digit Span subtest of the WISC may be related to the below average performance on the Math, Reading Recognition, and Spelling subtests of the PIAT. However, the significant above average performance on the Similarities and Vocabulary subtests of the WISC are sufficient to compensate for average performance in Reading Comprehension and the General Information subtest of the PIAT.

The female subject whose ITPA performance profile is presented in Figure 63 (Outlying Cluster 19) is indicative of a child who has an extreme memory deficit with more than three standard deviations below the mean performance on the Auditory Sequential Memory and Visual Sequential Memory subtests of the ITPA. These auditory and visual memory deficits correspond to significant below average performance on the Math, Reading Recognition, Reading Comprehension, and Total achievement score. However, the strengths which are indicated in the Auditory Reception, Manual Expression, Visual Closure and Sound Blending subtests are sufficient to compensate for average Reading Comprehension and Spelling performance and above average performance on the General Information subtest of the PIAT. These academic strengths and weaknesses correspond to the below average performance on the Similarities and Digit Span subtests of the WISC with this child having a 95 Verbal IQ.

The male child whose profile is represented in Figure 64 (Outlying Cluster 21) has extremely below average performance on the ITPA, more than two standard deviations below the norm mean. This child's performance on the WISC indicates that he is in the mentally retarded range (Verbal IQ = 62) with corresponding extremely low performance on the PIAT and other diagnostic tests. This child's Manual Expression skills are relatively average, an indication that this may be an avenue which should be explored for teaching purposes.

Figure 65 (Outlying Cluster 23) is indicative of children who can be said to have a specific learning disability with various extreme strengths and weaknesses as indicated on the ITPA performance profile. One of these children has a Verbal IQ of 120 and the other has a 130 Verbal IQ. Both subjects perform significantly above average on all of the WISC subtests with the exception of one subject who performs at the mean on the Comprehension subtest. Both children have varying degrees of strengths and weaknesses in the various achievement areas with relatively average performance on both the Spelling and Reading Comprehension subtests of the PIAT.

The ITPA performance profile of the eight children is illustrated in Figure 66 (Cluster 5) with an average elevation of approximately one standard deviation above the norm. However, there is a significant deficit indicated in the Verbal Expression subtest and a significant strength indicated in the Visual Sequential Memory subtest. This group profile corresponds to significant above average performance for some of the subjects on the Digit Span subtest of the WISC (M-%tile = 75, 97.5% ranging from the 24th to 95th %tile). These children have sufficient skills to have average performance on all the achievement tests and with a general average Verbal IQ.

Figure 67 (Cluster 6) contains 59 subjects representing 5.2% of the total first grade population who have approximately one standard deviation above the mean performance on the ITPA, a relatively flat above norm profile. Such a profile is indicative of children who have significant above average performance in all the achievement measures and all the WISC subtests with Verbal IQ's ranging from 106 to 113 for 97.5% of the children in this group.

The ITPA performance profile for the 20 subjects in Figure 68 (Cluster 18) is relatively flat and normal with the exception of one deficit area indicated in the Visual Sequential Memory subtest of the ITPA. However, this group of children has above average performance on the Similarities subtest of the WISC with average performance on all the other diagnostic measures.

Another above average performance profile is illustrated in Figure 69 (Cluster 24), 64 subjects representing 16.5% of the total first grade population. This profile is on the average a standard deviation or more above the mean with specific strengths indicated on the various auditory subtests. In correspondence, all of the achievement measures are significantly above the mean and all of the WISC measures are above norm, with 97.5% of these subjects having Verbal IQ's ranging from 111 to 118.

The remaining four clusters represented in Figure 70 through Figure 73 are average to above average on the majority of the ITPA subtests. In correspondence, all these profiles are indicative of children who perform in the average range on all the diagnostic measures.

Discussion: Cluster Analysis on the ITPA

This cluster analysis study has determined that there are seven relatively homogeneous ITPA performance profiles including two low frequency outlying clusters in kindergarten which are differentially related to significant below average performance on the PIAT, WISC, VMI, and Experimental Phonetics Test. Similarly, there are eight homogeneous performance profiles in the first grade sample and six low frequency outlying clusters which are significantly related to below and above average performance on the individually administered diagnostic measures. Within both grades, there are four ITPA performance profile groups which are differentially related to above average performance on the various follow-up assessment measures. Although there are similar ITPA performance groups related to academic performance in both grades, the degree of similarity is consistent only in the relative shape of the profile. Typically, there are different patterns of strengths and weaknesses which characterize each of the ITPA profiles within each grade. The implication is that the predictive ITPA clusters do reflect underlying skill differences associated with grade or that lower reliability of some of the scales produced some random groups. It is more important to attend to the patterns of strengths and weaknesses, the degree of discrepancy within each performance profile, since this seems to be a primary predictor of whether or not there are specific deficits in academic performance or other diagnostic assessment measures. For example, if one examines the first grade ITPA performance cluster in Figure 56 (Cluster 12), it is evident that the average scaled score for this group of children would be at the ITPA mean across the 12 subtest measures. However, there are significant patterns of strengths and weaknesses which are significantly related to below average performance on the various diagnostic subtests.

There are apparently two dimensions which the diagnostician needs to adhere to in utilization of the ITPA profile as an indicator of performance on the PIAT achievement and WISC-Verbal intelligence measures. First is the degree of variability, the pattern of strengths and weaknesses which has been noted above. Second is the overall mean level of the profile, above or below the ITPA norm. If the majority of the scores on the ITPA are approximately one standard deviation or more below the mean, one can expect that several academic or intelligence performance measures will also have a corresponding below average level. Similarly, if the average profile is approximately one standard deviation or more above the mean for the majority of the ITPA subtests, one can expect that academic and intelligence performance will be significantly above average. Several common ITPA clusters whose mean level was only half a standard deviation below norm and had some minor subtest discrepancies were predictive of severe below average achievement on only one achievement subtest or one WISC-Verbal subtest. There were other clusters which predicted below average performance across all achievement or all WISC measures. It remains an empirical question as to whether below average performance on all the academic measures or the majority of the academic measures is more academically debilitating than one deficit which is a standard deviation or more above or below the mean. For example, a child with one deficiency (Spelling or Auditory Sequential Memory) may have a sufficient number of compensating strengths which will permit him to successfully cope with the vast majority of academic requirements, whereas the child who has slightly below average performance (30th to 40th %tile) in the majority of skill areas may have a high degree of difficulty in dealing with the majority of the school curriculum.

The ITPA was designed as an intra-individual difference assessment measure. This study has demonstrated that, while there are relatively homogeneous performance groups based on cluster analysis of the ITPA variables, the pattern of individual strengths and weaknesses is of major significance in determining whether or not there will be above or below average academic performance. Previous studies on the ITPA have met with varying degrees of success in demonstrating that there is a significant relationship between ITPA performance and academic achievement. The vast majority of these studies have been correlational designs which gathered together groups of convenience samples from locally available school districts. Such studies do not have the statistical utility to isolate the low frequency events which are most predictive of academic failure. Correlational analyses can only determine the degree of variance which the major groups account for in predicting academic measures. To place this statement in perspective, consider the fact that, if one examines the most frequent ITPA profile which is significantly related to below average academic performance, there is less than a 50-50 chance of finding such a child in any one classroom. When one gathers a sample from across the broad range of abilities which exist in the general school population, the low frequency event which is of primary interest to psychology and special education can be lost to error variance. The most debilitating clusters of children derived from the ITPA are those which were described as outlying clusters, N's ranging from one to four. There is less than .5% probability of finding such a child in any one classroom. In the past, numerous studies have been conducted trying to demonstrate that performance on various ITPA measures can or cannot be increased through special remediation techniques. The essence of this study dictates that a researcher cannot select a group of children across the broad range of the school population, administer the ITPA, conduct a remediation program, and expect to find a significant difference. One must first isolate a group of children who have common performance patterns from the general population before there is any efficacy and reliability to such process training research. It has not been the province of this study to determine whether process training is an effective remediational technique. The present research provides an empirically based system for gathering samples for such studies. Researchers also need to be more aware of the heterogeneity of skills which exist in special education classes. There is less than .5% probability of finding a common ITPA deficit profile in any one special education class. The implication is that one would need to go to at least 100 special education classrooms, e.g., LD classrooms, before finding five to ten children who have a similar performance pattern.

Although the present study has demonstrated that there are relatively homogeneous performance profiles that can be derived from cluster analyses on the ITPA, another sample selection procedure is suggested prior to cluster analysis which may produce even more homogeneous profiles which demonstrate even more significant differential diagnostic utility. Since it is the pattern of intra-individual strengths and weaknesses which is of primary importance in predicting academic deficiencies, one could select a group of children based on a discrepancy criteria across the twelve ITPA scores in forming a "high risk" group. Cluster analysis on this "high risk" group should have greater utility in determining whether or not the derived patterns have more specific relationships to other diagnostic or achievement measures. Such a study will be conducted on the present data set in the near future.

It has not been the province of the present study to provide a detailed clinical interpretation of each differentially predictive ITPA cluster profile. The mean cluster profiles which were presented subsume the vast majority of the intra-individual variability which needs to be examined if an accurate interpretation is to be achieved. Although the clusters which were derived are relatively homogeneous and significantly different in comparison to other group clusters, detailed clinical analysis should be based on individual profiles within each cluster. This is necessary to assess the actual degree of discrepancy between mean scaled scores and subtest scaled scores, as this is indicative of discrepant ITPA process and channel functions. Diagnosis is an individually oriented process, whereas the cluster data has utility in forming relatively common performance groups for research purposes. Kirk and Kirk (1973) have written detailed procedures for educational diagnosis and subsequent remedial plans based on the ITPA performance profile. The present study has added substantial empirical validity to the differential diagnostic utility of the ITPA.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this multi-faceted investigation was to (a) compare factor analytic results on "high risk" samples of children with a control sample of children in kindergarten and first grade, (b) to examine the concurrent and predictive validity of various group and individually administered tests with other achievement and individual diagnostic measures and teacher ratings of school skills, (c) to investigate the utility of cluster analytic techniques in identifying common performance groups, and (d) to determine the relationship between these performance clusters with individual assessment techniques.

Method

The "high risk" population in this study was selected by administering SCREEN (an early identification test containing four group administered subtests and a teacher rating scale) to 3,500 kindergarten and first grade children in six suburban school districts. From this sample 764 children were selected and followed up with an individually administered diagnostic battery. The diagnostic battery included the Illinois Test of Psycholinguistic Abilities (ITPA), the Wechsler Intelligence Test for Children-Verbal Scale (WISC), the Beery Visual Motor Integration test (VMI), the Peabody Individual Achievement Test (PIAT), and an Experimental Phonetics Test.

Two-thirds of the 764 children were considered to be "high risk" based upon the SCREEN test results and/or teacher referrals while the reamining third of the sample constituted a control group, selected randomly from the remaining children who were neither teacher referred nor SCREEN referred. Thus, four subsamples were selected for research purposes: (a) Teacher Referred, (b) SCREEN Referred, (c) teacher and SCREEN referred (Common Referral), and (d) a "normal" sample (Comparison Group).

This chapter presents a summary of the major findings for each of four studies. The first study utilized the above research samples for factor analysis of the SCREEN and ITPA tests. In the second study the follow-up diagnostic data as well as initial screening and group achievement data, the Metropolitan Readiness Test (MRT) for kindergarten and the Metropolitan Achievement (MAT) for first grade, were examined in determining the concurrent validity of the various test measures.

For the third study a 2½ year follow-up was conducted with the 764 children by administering achievement tests and teacher ratings of school skills. The SRA Assessment Survey or the Cooperative Primary Test was administered to the original kindergarten children while they were in third grade. The Iowa Test of Educational Development, the Stanford Achievement Test, or the Cooperative Primary Test was administered to the original first grade children when they were in fourth grade. The screening and diagnostic data were examined in relation to their predictive validity with the follow-up achievement tests and teacher ratings.

In the fourth study cluster analytic techniques were utilized to isolate homogeneous clusters of children who displayed specific performance patterns on the SCREEN and ITPA tests. These performance clusters were then examined to determine if they were differentially related to performance on the WISC, the PIAT, the VMI, and the Experimental Phonetics Test.

Results

Study One

The purpose of Study One was to determine whether samples composed of "high risk" children would yield a more complex factor structure than that obtained across the total population. Factor analyses were conducted separately on the SCREEN test and on the ITPA with the "high risk" samples and compared to those obtained using the comparison sample and total sample within kindergarten and first grade.

Factor Analysis on SCREEN. The factor analyses on the SCREEN test for the various subpopulations and total group indicated that there was (1) a general readiness factor and (2) a teacher rating factor. The four factorally derived teacher rating scales (Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment and Immaturity) produced similar loadings on the same factor, while the teacher ratings of Cognitive-Perceptual Skills also loaded on the general readiness factor. These results indicate that there are considerable "halo" effects occurring in the teacher rating scales.

More complex factor structures were obtained with the SCREEN test on the various "high risk" samples in comparison to the simple factors obtained with the control samples within grades. These results suggest that researchers need to exercise caution when interpreting factor analyses derived from divergent populations.

Factor Analysis on the ITPA. There were three major findings: (1) an auditory channel factor, (2) a visual channel factor, and (3) an expressive process factor.

The factor analysis on the ITPA utilizing the various subpopulations in this study also produced more complex factor structures when utilizing the "high risk" samples in comparison to the total population. Inability to extract meaningful factors for the ITPA utilizing "normal" samples was illustrated in comparing the factor analytic results of the SCREEN Referred sample to the Comparison Group. The divergent and virtually uninterpretable factor analytic results which were obtained on the Teacher Referred subpopulation should be noted by those who conduct factor analyses with this psycholinguistic assessment technique.

Study Two

The primary purpose of this study was to examine the concurrent validity of the SCREEN and ITPA tests in relation to group achievement and other individual diagnostic measures.

SCREEN Concurrent Validity. The results of this study indicate that the concurrent predictive power of the group administered SCREEN procedure compares favorably with that of the individually administered diagnostic instruments in most cases. The SCREEN multiple R of .65 was found to be a higher predictor of the Metropolitan Readiness Test total score in comparison to the ITPA (R = .48), PIAT (R = .60) and the WISC (R = .48). SCREEN multiple R's with the Metropolitan Achievement Test were also relatively high averaging .72, but were not significantly different from .70 for the PIAT. The average multiple R's for the ITPA and WISC with the MAT were .54 and .28, respectively. Thus, the WISC-Verbal Scale was found to be a low predictor of the MRT and MAT not only in comparison to the SCREEN battery but also in comparison to the diagnostic measures.

Since there was a low degree of relationship between the SCREEN battery and the WISC-Verbal subscales (average R = .36), one can state that the SCREEN test essentially is not a measure of general intelligence but more an indicator of academic performance in the early school grades. It was noted that the combination of SCREEN subtests necessary to predict kindergarten performance differs from those needed to predict first grade performance on the PIAT and Metropolitan series. The SCREEN multiple R with the PIAT total score was .66 in both grades in comparison to the ITPA correlation of .77 for kindergarten and .76 for first grade. Results of the current study considered in conjunction with the SCREEN norm sample studies demonstrate substantial concurrent validity with group and individually administered achievement measures.

ITPA Concurrent Validity. The ITPA was found to be a moderate to substantial predictor of the WISC-Verbal subtests (average R = .58). The correlations for the ITPA battery with the Metropolitan series were found to be in the low to moderate range for the kindergarten sample (R range = .37 to .51) and relatively higher in the first grade sample (R range = .53 to .56). In comparison to the WISC-Verbal Scale, the ITPA generally has higher correlations with kindergarten readiness and achievement in first grade. However, the ITPA generally does not correlate as high as the SCREEN or PIAT tests as predictors of the Metropolitan series. The multiple correlations for the ITPA ranged from .60 to .77 with the PIAT battery in both grades.

An important result of these concurrent validity studies was stressed. The mulitple regression equations for both SCREEN and the ITPA in predicting various criterion measures indicated that either all or in most cases the majority of their subtests contributed significant unique variance. Examination of the PIAT and the WISC-Verbal multiple regression equations in predicting the Metropolitan series present a different picture. It is only within the kindergarten sample that the PIAT had a similar prediction pattern. In the first grade one PIAT subtest, Reading Recognition, adds over 90% of the predicted variance with the remaining minor variance being accounted for by only one or two other subtests.

In general, the WISC-Verbal Scale was found to be a relatively low predictor of the Metropolitan series with the additional fact that one variable, the Similarities subtest, accounts for 80% to 90% of the predicted variance in both kindergarten and first grade. Evidence from this concurrent validity study indicates that there may be little validity for utilization of the WISC as a differential predictor of early school performance across the general population.

Study Three

This study examined the predictive validity of the SCREEN and ITPA tests in relation to 2½ year follow-up group achievement tests and teacher ratings of school skills. In addition, the predictive validity of the PIAT, WISC-Verbal, Phonetics Test, Beery VMI, Metropolitan Readiness Test, and Metropolitan Achievement Test were assessed in relation to the follow-up achievement and teacher rating data.

The predictive validity results of SCREEN with achievement tests compared favorably with the correlations obtained by the other predictor measures. The average multiple correlation of .70 for the SCREEN test battery with the subtests of five different achievement tests in third and fourth grade was the same as the average R for the PIAT and not significantly different from .74 for the MRT and .76 for the MAT. This average multiple correlation of .70 for the SCREEN battery with achievement tests 2½ years later was substantially above the WISC-Verbal battery average of .43 and slightly above the .62 average correlation for the ITPA.

Substantial predictive validity of SCREEN was also demonstrated in comparing the average multiple correlations of the predictors in this study with the composite achievement scores in third and fourth grade. These average multiple correlations were: .76 for SCREEN, .69 for the ITPA, .77 for the PIAT, .47 for the WISC, .77 for the MRT with one composite achievement measure, and .86 for the MAT with two composite achievement measures.

SCREEN, the ITPA, PIAT, and MRT batteries account for approximately the same amount of variance (48% to 59%) in predicting composite achievement scores over a 2½ year period. The concurrent validity study with the SCREEN norm sample produced an average multiple correlation of .73 across 191 achievement subtest variables. This latter result is comparable to the average predictive correlation coefficient of .70 over a 2½ year period with 47 achievement subtests criterion variables. The average multiple correlation for the SCREEN battery with the composite achievement scores in the present predictive validity study was .76 in comparison to .84, the average concurrent validity correlation with 19 total achievement test scores in the SCREEN norm study. Thus, the predictive validity of the SCREEN battery with group administered achievement procedures is not substantially different from its concurrent validity coefficients in most cases. The predictive validity coefficients that were obtained with the SCREEN battery were substantial given that one can expect significant differences in correlations over a 2½ year period.

The average Pearson correlation of .59 for the PIAT total score with the achievement measures 2½ years later was substantially higher than .47 for SCREEN and .44 for the ITPA. In general, the total scores associated with the SCREEN, ITPA, and PIAT batteries have moderate Pearson correlations with the criterion achievement subtests. In comparison, the average WISC Pearson correlations of .33 and .28 for the VMI are substantially below the other predictor measures. The multiple correlations for the WISC and VMI in predicting group administered achievement tests over a 2½ year period were also quite low. Evidence from this predictive validity study in conjunction with the previous concurrent validity study suggest that neither the WISC nor the VMI are substantial predictors of group administered achievement tests.

The results from this predictive validity study indicate that the ITPA is a moderate predictor of group achievement measures over a 2½ year period. An average multiple correlation of .62 for the ITPA across 47 achievement subtests was less than that obtained for the SCREEN battery, the PIAT, and the Metropolitan series. However, the ITPA average ultiple correlation of .69 with the composite achievement measures over the same period of time is within the same range as the other predictor measures in this study.

Study Four

There were two main purposes to this study: (1) to investigate the utility of cluster analytic techniques in identifying more homogeneous subclusters of children who display specific performance patterns on the group administered early identification SCREEN test and the individually administered ITPA; (2) to determine the relationship between these specific homogeneous performance patterns derived from these cluster analyses with individually administered diagnostic tests and other population characteristic data. In the first portion of this study, the SCREEN battery was cluster analyzed within both the total kindergarten and first grade samples receiving the individual diagnostic follow-up. In the second portion of this study, the ITPA was also cluster analyzed within grade to derive homogeneous performance patterns. The clusters that were derived were then analyzed to determine whether they differentially predicted PIAT, WISC, VMI, Phonetics Test, and Age variables (and the ITPA variables for the SCREEN clusters).

Cluster Analysis on the SCREEN Early Identification Battery. There were a total of nine homogeneous SCREEN profiles which were significantly related to below average performance as assessed through the individual concurrent validity diagnostic follow-up. In the kindergarten sample, there were seven "high risk" SCREEN clusters which were differentially related to below average performance on the various diagnostic measures. These profiles consisted of 30.9% of the total kindergarten sample. There were six "high risk" profiles in the first grade sample, four of which were replicated from the kindergarten cluster study, containing 23.2% of the total first grade sample. These relatively few profiles can provide a substantial empirical foundation for identifying those children in the early school grades who have a high potential for serious academic problems prior to jeopardizing the child's school career. To place these data in a clearer perspective, the "high risk" profiles in the present study make up 6.6% of the total kindergarten population which received screening services in 1974; the first grade "high risk" profiles account for 5.1% of the original total sample.

In general, the Teacher Referred, SCREEN Referred, Common Referral, and Comparison Group subsamples which were previously generated for experimental purposes in this research study do not represent useful correlates for the SCREEN-derived clusters. The major problem with these categories was in the large number of teacher over- and under-referrals based on the ratings of Cognitive-Perceptual Skills, Behavioral Adjustment, Social Adjustment, and Immaturity. The vast majority of children who received poor teacher ratings were boys, perceived as behavior problems but who had average to above average performance on all the diagnostic measures. There were a variety of such clusters or performance groups in both kindergarten and first grade based solely on the teacher ratings which were not differentially related to academic school problems.

The point is further illustrated when one utilizes the original conservative 7th percentile or lower criteria as the basis for establishing the SCREEN Referred category. If one wished to utilize such a conservative referral cut-off point, there would be an 81% hit rate in kindergarten and a 94% hit rate in first grade referrals of those children in the "high risk" cluster groups which were significantly related to below average performance on the diagnostic measures. In comparison, the Teacher Referred "hits" were 70% for the kindergarten sample and 66% for the first grade sample. Of course, utilizing a higher percentile, e.g., one standard deviation, or actual similarity to the major "high risk" cluster performance profiles would permit the SCREEN Referral to reach extremely close to 100% accuracy in predicting those children who have a high potential for below average academic performance.

The teacher ratings were found to have their best utility in predicting educational deficits only when used in combination with other objective child skill tests. While teacher referrals based upon ratings of only behavior, social adjustment, or immaturity are not generally predictive of academic success or failure, they may be related to criterion variables which were not studied in the present research. For example, some of these teacher rating performance profiles may be related to social and emotional assessment procedures, e.g., the Children's Apperception Test, sociometric indices, etc.

Cluster Analysis on the ITPA. The results of the cluster analysis on the ITPA have found seven relatively homogeneous ITPA performance profiles including three low frequency outlying clusters in kindergarten which are differentially related to significantly below average performance on the PIAT, WISC, VMI, and the Experimental Phonetics Test. There are eight homogeneous ITPA performance profiles in the first grade sample and six low frequency outlying clusters which were significantly related to below and above average performance on various diagnostic measures. Within both grades, there were four ITPA performance profile groups which are differentially related to above average performance on the various follow-up assessment measures.

Although there are similar ITPA performance groups related to academic performance in both grades, the degree of similarity is consistent only in the relative shape of the profile. There are two dimensions which diagnosticians need to recognize in utilizing the ITPA profile as an indicator of performance on the PIAT achievement and WISC-Verbal intelligence measures. First is the pattern of strengths and weaknesses, the degree of discrepancy within each performance profile, since this seems to be a primary predictor of whether or not there are specific deficits in academic performance or other diagnostic measures in the current research. Secondly, one needs to note the overall mean level of performance represented by the profile, above or below average discrepancy from the ITPA norm.

The results of this indicate that if the majority of the scores on the ITPA subtests are approximately one standard deviation or more below the mean, one can expect that several academic or intelligence or performance measures will also have a corresponding below average level. Similarly, if the average profile is approximately one standard deviation or more above the mean for the majority of the ITPA subtests, one can expect that the academic and intelligence performance will be significantly above average.

Discussion

Study One: Discussion

The factor analysis on the SCREEN and ITPA tests yielded more complex factor structures when utilizing "high risk" subpopulations. Typically, researchers use relatively "normal" populations for selecting variables and defining constructs underlying testing instruments. This research suggests that if a test is to be developed to identify a certain subpopulation, then it would be advantageous to examine sufficient numbers of that specific population in isolation from samples representing more diverse ranges of behavior. A natural corollary of the latter statement is relevant to understanding variables which are important for classification. One needs to examine subsamples of the population which are representative of the types of problems that one is trying to understand or isolate, such that important correlates can be readily identified.

More meaningful factors were extracted on the SCREEN referred sample in comparison to the sample referred by teachers. This result is probably related to the "halo" effects within the teacher rating scales and vague teacher referral criteria. There is a teacher emphasis on behavior adjustment, social skills, and maturity which seems to produce unnecessary referrals which are not related to academic skill problems. These results suggest that while teachers do have a good idea about the intellectual capabilities of many of their pupils, their judgments can be biased by other factors which may lead to serious mistakes in referring children for psychoeducational evaluation. It would seem that convenient teacher referred samples offer researchers little opportunity of investigating atypical functioning due to extremely heterogeneous population characteristics.

Study Two: Discussion

SCREEN Concurrent Validity. It appears that the group administered SCREEN battery predicts concurrent achievement test criteria and other measures almost as well as or higher than the individually administered diagnostic measures. When the group tests are used as criteria and when the time interval between the SCREEN testing and the criterion measurement is short, SCREEN predicts as well as or higher than the much more expensive individually administered diagnostic tests.

SCREEN had a low degree of relationship with the WISC-Verbal subscales in comparison to relatively high correlations with achievement measures. This result suggests that SCREEN essentially is not a measure of general intelligence but more an indicator of academic performance in the early school grades. This latter finding provides a substantial basis for labeling the major SCREEN factor found in the factor analytic study as "general readiness" rather than "general intelligence."

The predictive differences that occurred between the SCREEN battery and the individually administered diagnostic tests may be accounted for by one or more of the following facts:

1. SCREEN and the Metropolitan series were administered by the classroom teacher in a group setting while the PIAT was administered by a diagnostician in an individual setting.
2. The PIAT testing was administered simultaneously with the diagnostic battery, both two to four months later than the SCREEN predictor.
3. The diagnostic predictors and the PIAT were administered in the same sitting by the same diagnostician.
4. The psychometric design of the SCREEN battery necessarily reduces the magnitude of statistical relationships between SCREEN and other tests which measure the whole range of functioning.
5. Similarity of item content increases the magnitude of the statistical relationship between predictor and criterion variables.

ITPA Concurrent Validity. The ITPA had relatively high concurrent correlations with the WISC-Verbal subscales and the PIAT. Generally, the ITPA did not correlate as high as the SCREEN or PIAT tests as predictors of the Metropolitan series. These results suggest that the ITPA has a higher degree of relationship with the individually administered achievement and intelligence measures in comparison to group administered tests.

One should consider two probable reasons for these relative differences in correlations between the various measures in this study. The first is related to assessment method variance in that the SCREEN battery is group administered, whereas the ITPA is individually administered. Method variance can have a considerable effect on the degree of relationship between predictors and criterion measures. Secondly, the higher relationship of the PIAT battery as a predictor of group administered readiness and achievement tests in comparison to the ITPA is probably related to the differences in item content. The PIAT test is designed specifically to measure the same type of content contained in group administered achievement tests. Thus, there is a high similarity between the constructs and items of the PIAT and the Metropolitan series. In comparison, the ITPA is not specifically designed to assess achievement but rather to assess various underlying processes which are related to language functions. When the design of the ITPA scales is considered in conjunction with its method of administration, moderate correlations with group administered achievement tests could be expected and were obtained in the present study.

Study Three: Discussion

The predictive validity results that were obtained in the present series of studies should be interpreted in terms of each battery's underlying theoretical assumptions. SCREEN is a comprehensive child test and teacher assessment battery which was designed to identify school adjustment and skill problems in the early grades (primarily kindergarten and first grade). It is noteworthy that the teacher group administered SCREEN battery predicts achievement test criteria over a 2½ year period as well as or higher than the more expensive individually administered diagnostic measures. In addition, the predictive validity coefficients for the SCREEN battery are not significantly different from its concurrent validity coefficients. The evidence from this predictive validity study in conjunction with previous concurrent validity studies with the SCREEN battery indicates that this procedure is a substantial predictor of group administered and individually administered achievement tests.

The ITPA battery was designed to assess dysfunctions which underlie various language processes. It was not specifically designed to predict school achievement measures. Even so, these validity studies indicate that the ITPA has an adequate degree of relationship with measures of school achievement over a 2½ year period. It is unlikely that the diagnostic utility of this instrument would be determined through correlational designs over a sample of children who have such a wide range of skills. The correlational techniques which are the basis for concurrent and predictive validity studies allow one to determine the degree of relationship between predictor and criterion measures across the general population being examined but do little in isolating the correlates of low frequency performance deficits. In all probability, it is these low frequency events which may be of diagnostic interest in special education and psychology, but their association to criterion measures are lost to variance across the wide range of skills in the general population.

Evidence from these predictive validity studies demonstrated that the WISC and VMI have a very low degree of relationship with achievement tests. The primary intention of the WISC battery was to assess intellect which was presumed to predict school achievement across the general population. In order to accomplish this prediction purpose, various subscales were added to the WISC battery by its authors. The present series of studies have clearly indicated that the WISC-Verbal Scale is a relatively low predictor of school achievement across a sample of children representing both a "high risk" and "normal" population. Therefore, there seems to be little efficacy in utilizing the WISC or the VMI as a differential diagnostic indicator of potential school success across the general school population. In particular, it is questionable as to whether the WISC should continue to be utilized as a routine assessment instrument when a child is referred to the school psychologist because of variously related school problems. Parenthetically, these data support the conclusion that utilization of various intelligence measures has become institutionalized rather than being based upon sound empirical evidence. However, previous studies with the WISC have indicated that it may have some utility with "highly select populations." In general, it may be safe to imply that the WISC and the VMI may have substantial relationships on certain types of achievement measures for certain groups of children.

The designated purpose of the PIAT was to assess school achievement in a variety of school related areas. When group administered achievement batteries are utilized as criterion measures, the PIAT battery demonstrates moderate to substantial concurrent and predictive validity. Similarly, the Metropolitan series was found to have a moderate to substantial relationship to other measures of achievement. When predictor criterion measures have similar item content on at least some of their subscales, e.g., achievement tests, the degree of relationship is substantially increased in comparison to other more diverse measures.

Study Four: Discussion

Cluster Analysis on SCREEN. The utility of the cluster analysis procedure in identifying relatively homogeneous performance profiles which have educational and predictive utility has been demonstrated in this study. One can generally state that when any one or combination of the SCREEN child skill tests, including Visual Skills, Auditory Skills, Figure Copying, and Basic Knowledge are in the "high risk" range, there is close to a 100% probability of these children having significantly below average performance on a variety of psychoeducational indices. When teacher ratings of Cognitive-Perceptual Skills are in agreement with the "high risk" child skill test profile, there is a correspondingly high probability that such children will have even more severe deficits as evidenced by the individual diagnostic assessment. Conversely, when the SCREEN battery profile was found to be in the superior range, one can accurately predict that such children will score significantly above average on a variety of psychoeducational assessment indices.

It was determined that 6.6% of the kindergarten population and 5.1% of the first grade population would be referred for individual diagnostic assessment if the nine "high risk" SCREEN profiles were utilized. These percentages are slightly conservative since not all the children scoring in the "high risk" ranges on the SCREEN battery received individual diagnostic assessments, due to parental permission requirements, summer vacations, and school transfers. However, it would not be unreasonable to expect school systems to provide individual diagnostic assessment services for approximately 7% of their kindergarten or first grade populations, especially since the referral could be cost effective in limiting unnecessary assessments.

One should note that while this screening procedure seems to increase the efficacy of referral especially when utilizing a "high risk" profile, no child should be labeled or otherwise categorized through any screening procedure. The early identification process represents an entry into an individually oriented service network which can provide extra educational help for those children who are most in need. This assistance may come through teachers who are more informed about the child's educational strengths and weaknesses and/or special education placements.

The nine "high risk" patterns which were differentially related to academic problems are relatively low frequency events which could not be isolated through correlational procedures as such infrequent groupings would be lost to error variance in correlating across the wide range of performance in the population. SCREEN profiles and variables which are most related to significant deficits in psycholinguistic skills, achievement, and varying degrees of verbal intelligence skills have been isolated. Primarily, various combinations of the child skill tests and teacher ratings of Cognitive-Perceptual Skills make up the SCREEN variables which have utility in predicting school success and failure in the current research. One should recognize that the diagnostic variables used in the present study only represent a small subset of possible correlates which could be examined. Structured teacher ratings integrated with child performance information can serve to provide a more comprehensive description of each child's in-class behaviors.

An early identification system which combines teacher ratings with child test assessment aids diagnosticians by focusing follow-up diagnostic assessment when needed and eliminates unnecessary referrals. Diagnosticians often feel that they have an impossible task when a child is referred for "general individual assessment." Administratively, a screening system, where teacher and diagnostician efforts are targeted, limits the follow-up battery to more specific questions which need to be examined in greater detail within the same time frame, thereby making diagnosis more cost effective. The diagnostic question for a child rated by the teacher as having Cognitive-Perceptual and Behavioral Adjustment problems, coupled with average or superior performance on the child test skill areas, differs from the follow-up hypothesis for a child at "high risk" in SCREEN skill areas and concurrent Behavioral Adjustment problems as observed by the teacher. In the first case, the school diagnostician could concentrate assessment questions on personality dimensions, peer relations, or poor family relations. The follow-up diagnosis for the child in the second example could be centered on more academically related questions. With the current mandate to provide screening, identification of all children who may be in need of special education services, administrators need to recognize that group data can be highly efficacious when tied to sound empirical correlates. Evidence from the present study clearly demonstrates that "down and dirty" teacher referral checklist systems do little good in accurately identifying children who have the potential for school failure in the early school grades.

In summary, when groups of children are combined through cluster analytic procedures based on relatively homogeneous SCREEN performance, the diagnostic and concurrent predictive utility is greatly enhanced. These target profiles can be utilized in future research by isolating groups of individuals from a large population who have common performance features which place them at "high risk" for academic failure in school. Generally, previous screening batteries have not been able to demonstrate such a high degree of reliability and validity in predicting early school success or failure.

The ethics and psychometrics of test development dictate that no assessment procedure should be considered totally reliable and valid. Such is the case with the SCREEN battery and the current research as it will be necessary to update the procedure to reflect the results of studies such as these. In addition, there needs to be a replication of the current research on another population to determine whether or not the "high risk" profiles are again identified and again prove to be differentially related to various diagnostic measures. Therefore, this study does not represent an end point in developing a more highly reliable and valid screening procedure, but rather a beginning in being able to isolate common clusters of learning problem children. Future research should address the point that relatively homogeneous learning problem groups need to be studied if there is to be efficacy in defining early identification procedures, in increasing the validity and utility of diagnosis, in planning various treatment programs, in conducting differential remediation research, and eventually in developing an educational classification system which has empirically based correlates.

Cluster Analysis on the ITPA. This research demonstrated that there were ITPA clusters which predicted below average performance across all achievement or all WISC measures, while other clusters predicted below average performance on one or two criterion variables. It remains an empirical question as to whether below average performance on all the academic measures or the majority of the academic measures is more debilitating than one deficit which is extremely severe. For example, the child with one deficiency (Spelling or Auditory Sequential Memory) may have a sufficient number of compensating strengths which permit him to cope successfully with the vast majority of academic requirements, whereas the child who is uniformly below average performance in the majority of skill areas may have great difficulty in dealing with the school curriculum.

The ITPA was essentially designed as an intra-individual difference assessment measure. This study has demonstrated that, while there are relatively homogeneous performance groups based on cluster analysis of the ITPA variables, the pattern of individual strengths and weaknesses is of major significance in determining whether or not there will be above or below average academic performance. Previous studies on the ITPA have shown varying degrees of success in demonstrating that there is a significant relationship between ITPA performance and academic achievement. The vast majority of the studies have used correlational designs and "convenience samples" from locally available school districts. Such studies do not have the statistical capability to isolate the low frequency events which are most predictive of academic failure. Correlational analyses can only determine the degree of variability that the major groups account for in predicting the academic measures. To place this statement in perspective, consider that the most frequent ITPA profile which is significantly related to below average academic performance is found in less than one child in fifty.

In the past, numerous studies have been conducted trying to demonstrate that performance on various ITPA measures can or cannot be increased through special remediation techniques. The current study shows that a researcher cannot select a group of children across the broad range of the school population, administer the ITPA, conduct a remediation program, and expect to find the ITPA data relevant. This same statement holds when one assesses across a variety of special education classrooms as there is less than a .5% probability of finding common ITPA deficit profiles in any one special education class. One must first isolate a group of children who have common ITPA performance patterns before there is any efficacy in a process training research study. The present research provides an emprically based system for designating samples for such studies.

Although the present study has demonstrated that there are relatively homogeneous performance profiles that can be derived through cluster analysis on ITPA scores, another sample selection procedure is suggested prior to cluster analysis which may produce even more homogeneous profiles which demonstrate even more significant differential diagnostic utility. Since it is the ITPA pattern of intra-individual strengths and weaknesses which is of primary importance in predicting the academic deficiencies, one could select a group of children based on the discrepancy criteria across the twelve ITPA scores in forming a "high risk" group. Cluster analysis on this "high risk" group should have greater utility in determining whether or not the derived patterns have more specific relationships to other diagnostic or achievement measures.

Future Research Implications

The present series of studies has demonstrated that there is a reliable and valid technology which has been developed for identifying relatively homogeneous groups of learning problem children. The major thrust has been to determine whether a statistical tool, cluster analysis, could be utilized with classroom screening data to group individuals with common performance features. While the research methodology has proven to be of great utility, one must recognize that this utility could not have been demonstrated if the initial screening were not reliable and validly related to school achievement. The present study has reached two major taxonomic goals:

1. the empirical grouping of "high risk" learning problem children and

2. the establishment of relevant diagnostic correlates which aid in understanding the types of learning problems that occur in the early school grades.

Since these learning problem groups have differential empirical correlates which give them empirical meaning, previously unnoticed associations between sets of variables can now be utilized in refining both the early identification screening procedure and the diagnostic follow-up procedures. It is extremely important for the field of special education to know that relatively homogeneous groups of learning problem children can be identified for future research purposes.

Not only has this study identified "high risk" learning problem subtypes and empirically validated their correlates through individual diagnostic follow-up, it also has demonstrated that relatively homogeneous clusters of "high risk" children could be grouped through analysis of an individual diagnostic procedure, thereby extending its empirical foundations for differential diagnostic purposes. The present research has laid an empirical foundation for a classification plan which is directly applicable to identifying educationally relevant subtypes in the school population. This plan would involve three major phases:

1. identifying target children through screening procedures,
2. identifying the various types of abilities contained in that target population, and
3. the further validation of the specific types of disabilities by establishing diagnostic and intervention correlates.

While no finished classification system has been established, there now exists a viable system for conducting meaningful psychoeducational research into the correlates of school failure. The broad categorical terms which currently exist in the educational system such as "learning disabled," "educable mentally retarded," "emotionally disturbed," and the like have simply not been very useful in the regular classroom, to the special education teacher, or to the researcher (although such terms may be necessary for administrative funding purposes). Educational researchers need not be hampered by the heterogeneity of learning problem samples, be they called learning disabled, mentally retarded, or brain injured, etc., but can study more homogeneous subgroups which are apt to possess high-level correlates of importance. Since there is less than a 50-50 chance that the most frequent screening profile or diagnostic profile found in this research will be evidenced in any classroom, future research needs to be cognizant of the logistical problems to be faced in accomplishing sensitive research. However, examining these more homogeneous groups should yield greater knowledge well worth the extra effort.

Since the common types of learning problems are low frequency events, screening across wide geographical regions, e.g., states, would not be particularly fruitful in replication of the present study. Alternatively, the procedures which were utilized could be applied in a dense geographic area, urban settings or large school districts, such that the logistics and fiscal dimensions do not become insurmountable. The numerical taxonomy methodology is directly applicable in studying the various psychoeducational dysfunctions which characterize children with learning problems and eventually in locating the specific etiologies associated with the subgroups found within the broad category of specific learning disabilities.

As a final note, one must be cognizant of the funding difficulties encountered in conducting such expensive, large scale, longitudinal research. Federal and state agencies should recognize that the long-term advantages outweigh any initial costs. If school systems are ever able to overcome the human costs of unreliably channeling children into non-functional categories, it will be necessary to conduct studies such as these. Education for all handicapped children does not dictate that children be identified by consensus and subsequently receive "by-guess and by-golly" remedial intervention. Research of this type needs to be continued if an educational classification system of the greatest predictability and practical assistance is ever to be established.

APPENDIX A

SUMMARY OF SCREEN RELIABILITY AND VALIDITY DATA (1975)

Description of the SCREEN Battery

SCREEN contains four 15-minute child test sessions (modules) and a teacher rating of pupil behavior scale (filled out on all the pupils). The four child test modules contain the following five subtests:

1. Self Concept and School Adjustment Index (SC-SAI)--the child answers 24 Yes/No self-referent questions such as: "Do you do well in school?"; "Do you have a lot of friends?"
2. Visual Skills--three types of items are used in this subtest: (a) Incidental Memory, a 12 item multiple-choice test of the child's memory for pictures of animals he has seen on earlier pages of the test booklet; (b) Letter Knowledge, an 11 item multiple-choice test of the child's knowledge of the letters of the alphabet; (c) Integration of Designs, a 5 item multiple-choice test of the child's recognition of a whole picture resulting from combining the parts of a separated picture.
3. Auditory Skills--three types of items are also used in this subtest: (a) Auditory Discrimination, a 22 item test of the child's capacity to tell if three spoken words are identical to each other or different; (b) Listening Comprehension, a 12 item test of the child's understanding of what happened

in a brief story read to the class by the teacher; (c) Digit Memory, an 11 item test of the child's memory for a number series (Digit Memory was not included in the 1974 edition).

4. Figure Copying--this score is based on the rated quality (one to nine) of the child's reproductions of six geometric designs (hand scored).
5. Basic Knowledge--the types of items used in this subtest are: (a) Concepts-Information, an 11 item multiple-choice pictoral test involving picture vocabulary and conceptual understanding, a sample item would be "Mark the picture that shows a cat farthest away from her food dish."; (b) Quantitative, a 12 item test of the child's capacity to count, recognize numbers, and to understand elementary number concepts; (c) Reasoning, 5 multiple-choice items asking the child to mark one picture out of four that does not belong with the others (Matrices), 5 multiple-choice items asking what picture has something wrong with it (Absurdities), and 5 multiple-choice pictoral items in which the child is asked to find a thing that is missing from a stimulus picture (Picture Completion).
6. General Readiness--this scale is a combination of Scores 2 through 5.

The teacher ratings of pupil behavior scale consists of 40 items selected on the basis of content and through factor analytic analysis. These 40 items provide scores on four factor scales that qualify teacher judgments of pupil behavior in classroom performance. These four teacher scales include:

1. Teacher Rating I, Cognitive-Perceptual Skills--this is a 10 item rating scale of the child's intellectual skills based on a five point scale; sample item: "Has trouble identifying common objects in a picture" (1-5, always to never).
2. Teacher Rating II, Behavioral Adjustment--this is a 10 item rating scale of the child's deportment; sample item: "Interrupts the work of other children" (1-5, always to never).
3. Teacher Rating III, Social Adjustment--this is a 10 item rating scale of the child's skills in dealing with peers; sample item: "Is ignored or avoided by other children" (1-5, always to never).
4. Teacher Rating IV, Immaturity--this is a 10 item rating scale of age appropriate behaviors; sample item: "Is over dependent on adults" (1-5, always to never).

Individual SCREEN Reports

An individual report is prepared on each child receiving SCREEN. The length of the report varies with the child's risk level but averages about two pages. Included in each report are the following kinds of information:

(1) Identifying information, including the child's name, birth date, sex, grade, and nature of class placement; the teacher's name, school, district, and state; date of testing.

(2) A summary of the child's past history of sensory, medical and educational testing as known by the school. The purpose of this section is to alert persons authorized to read the report of any auxiliary problems that may exist or at least whether or not such problems have been ruled out. By fulfilling this information-collating function, the SCREEN report enhances communication between a pupil's teachers from one year to the next.

(3) A profiling of the child's scores on all the SCREEN subtests together with a statement as to the degree of risk for educational or adjustment problems each score represents.

(4) A narrative section of the report points to areas of significant weakness by noting the type and content of errors that the child makes. This information is immediately useful to teachers.

(5) The pattern of the child's scores is described in narrative form so that the teacher will become particularly aware of the child's intra-individual differences rather than simply the child's standing relative to other children.

(6) A summary is provided that indicates behaviors to which the teacher should be particularly attentive; in the most serious cases, a recommendation for follow-up testing is given. Such recommendations are given sparingly in recognition of the limited availability of diagnostic services. The specific nature of the diagnostic question is focused to permit a more efficient use of the diagnostician's time (Senf & Comrey, 1975, p. 456).

Reliability and Validity Data

The following two pages provide a brief summary of the reliability and validity studies which were conducted with the SCREEN norm sample in 1975.

SCREEN is a comprehensive child test and teacher assessment battery designed to identify school adjustment and skill problems in the early grades (primarily kindergarten and first grade). The child test portion of the battery includes assessment of (1) child motivation and school adjustment, (2) visual skills, (3) auditory skills, (4) visual-motor ability, (5) basic knowledge, and (6) general readiness (comprised of the preceding four skill areas). The teacher rating portion of the battery contains four factorially derived scales each containing ten items and termed (1) cognitive-perceptual skills, (2) behavioral adjustment, (3) social adjustment, and (4) immaturity. The battery was graphically designed for classroom administration by the regular classroom teacher without necessitating specific training. A further description of the content of each of the areas assessed and item format can be found in a paper by Senf and Comrey (1975).

SCREEN was constructed in early 1974 and subsequently administered to approximately 3,500 kindergarten and first grade pupils. The present test represents a substantial reduction in item length and consequently administration time from the original edition as well as refinement based on teacher feedback and statistical analyses of the 1974 edition. The resulting revision was administered to approximately 9,500 pupils in grades kindergarten through three in the spring of 1975.

Subjects. A random half of the school districts containing elementary school pupils throughout the state of Illinois were invited to participate in this study. From some 25,000 requests, a sample of approximately 9,500 pupils was selected from 70 school districts stratified by grade (K through third) and population density of the school district (rural--less than 2,500; towns--2,500 to 25,000; suburban--area adjacent to urban areas; and city-urban--greater than 30,000). While the majority of children in each grade attended regular classrooms, children receiving educational assistance through resource room or self-contained classes were also included.

Procedures. Having as background information a brief statement regarding the purposes of SCREEN and a sample of the report to be received on each child, teachers utilized the SCREEN Teachers Manual without further assistance to administer the SCREEN child tests to their pupils in a classroom group.

Results

RELIABILITY. The split half reliabilities for the ten SCREEN scores, computed separately for each grade, are presented in the following table.

	SCREEN Score	K	First	Second	Third
1.	Self Concept and School Adjustment	.81	.75	.78	.75
2.	Visual Skills	.85	.78	.67	.55
3.	Auditory Skills	.90	.87	.84	.82
4.	Figure Copying	.76	.76	.78	.82
5.	Basic Knowledge	.85	.84	.87	.83
6.	General Readiness	.93	.91	.91	.90
7.	TR-I Cognitive-Perceptual Skills	.96	.96	.95	.95
8.	TR-II Behavioral Adjustment	.94	.95	.95	.95
9.	TR-III Social Adjustment	.88	.90	.91	.90
10.	TR-IV Immaturity	.87	.88	.86	.86

All coefficients show adequate reliability especially in kindergarten and first grade where the test would primarily be utilized.

A test-retest reliability study was conducted using a two week inter-test interval on an inner-city sample. The resulting coefficients are presented in the following table.

Senf, G. M., & Comrey, A. L. State initiative in learning disabilities: Illinois' Project SCREEN. Report I: The SCREEN early identification battery. Journal of Learning Disabilities, 1975, 8, 451-457.

Note: Manuscripts describing these data in greater detail are under editorial review. For further information, write to Gerald M. Senf, Psychology Department, University of Illinois, Chicago, Illinois 60680.

	SCREEN Score	K	First	Second	Third
1.	Self Concept and School Adjustment	.51	.61	.60	.72
2.	Visual Skills	.77	.85	.56	.57
3.	Auditory Skills	.85	.83	.81	.73
4.	Figure Copying	.77	.85	.76	.77
5.	Basic Knowledge	.62	.91	.87	.68
6.	General Readiness	.88	.94	.91	.79
7.	TR-I Cognitive-Perceptual Skills	.97	.98	.89	.96
8.	TR-II Behavioral Adjustment	.95	.99	.90	.99
9.	TR-III Social Adjustment	.96	.97	.75	.98
10.	TR-IV Immaturity	.96	.95	.71	.95
	Number of Pupils	65	67	73	46

These reliabilities show greater variability than the split-half ones, likely due to the small sample size as well as to the intervening period. The average correlation for grades K through three respectively is down .05, up .03, down .08, and down .02. Compared to individually administered tests, these reliabilities are acceptably high.

VALIDITY. A requirement of participation was that the school supply achievement data on each child receiving the SCREEN battery. Twenty-nine different tests containing 191 variables were used as criteria for prediction between nine SCREEN scores (omitting General Readiness because it represents a summation of all the other performance scores). The following table presents the average multiple correlation for each criterion test and the multiple correlation with the criterion test Total Score for the 19 tests which calculate totals.

Grade	Test	Average Multiple Correlation	Correlation with Total Score
K	Analysis of Readiness Skills	.72	.87
K	Gates-MacGinitie Reading-Readiness Sk.	.65	.82
K	Metropolitan Achievement-Primer	.70	
K	Metropolitan Readiness Test	.67	.86
K	Primary Mental Abilities-Readiness Lev.	.68	.82
K	SRA Primary Mental Abilities Test	.89	.94
K	Stanford Early School Achievement-Lev. I	.74	.83
1	Gates-MacGinitie Reading-Readiness Sk.	.84	.82
1	Metropolitan Achievement-Primary I	.70	
1	Metropolitan Achievement-Primary I (Fm. A)	.71	
1	Otis Lennon Mental Ability Test	.69	
1	Peabody PVT IQ	.67	
1	SRA Assessment Survey: Achievement-Primary	.80	.99
1	SRA Primary Mental Abilities Test	.64	.73
1	Stanford Achievement Test-Primary Lev. I	.68	.76
1	Stanford Achievement Test-Primary Lev. II	.79	
1	Tests of Basic Experiences	.70	
2	California Achievement Test	.75	.75
2	Metropolitan Achiev.-Primary II (Fm. A)	.68	
2	SRA Assessment Survey: Achievement-Primary	.77	.82
2	Stanford Achievement Test-Primary Lev. I	.69	.82
2	Stanford Achievement Test-Primary Lev. II	.78	.86
3	California Achievement Test	.88	.88
3	Iowa Test of Basic Skills (ITBS)	.65	.76
3	Metropolitan Achiev.-Elementary Battery	.78	
3	Metropolitan Achievement-Primary II	.71	
3	SRA Assessment Survey: Achievement-Primary	.79	.85
3	Stanford Achievement Test-Primary Lev. II	.72	.96
3	Stanford Achievement Test-Primary Lev. III	.77	.85

The average multiple correlation is .73 and .84 for the 19 Total Score criterion measures. Inasmuch as there may exist anywhere from one week to eight months between the SCREEN testing and the prior collection of the achievement criterion data, these high multiple correlations are extremely encouraging, especially given the large number and variety of criterion tests used.

APPENDIX B

DESCRIPTION OF THE ITPA

The experimental version of the ITPA was developed in 1963 and revised in 1969. The following description of the ITPA model and subtests is quoted in part from Kirk and Kirk (1973) and Paraskevopoulos and Kirk (1969).

Channels of Communication

Many combinations of input and output are possible, but due to practical limitations, the ITPA incorporates only two:

1. the auditory-vocal channel, i.e., the course by which sensory impressions are received through the ear and responses expressed verbally;
2. the visual-motor channel, i.e., the course by which sensory impressions are received through the eye and responses expressed through gesture and movement.

Psycholinguistic Processes

In analyzing behavior which occurs in the acquisition and use of language, three main processes are considered:

1. the receptive process, i.e., recognition and/or understanding of what is (a) seen or (b) heard;

2. the organizing process, i.e., education of relationships from what is or has been (a) seen or (b) heard;
3. the expressive process, i.e., the use of those skills necessary to express ideas (a) verbally or (b) by gesture or movement.

Levels of Organization of Communication Habits

The degree to which communication behavior is organized within the individual determines the level of functioning. Two levels are postulated in the clinical model of the ITPA:

1. The representational level includes behavior which requires the more complex mediating process of utilizing symbols which carry the meaning.
2. The automatic level includes communication behavior requiring less voluntary but highly organized and integrated patterns. This includes such activities as visual and auditory closure, speed of perception, ability to reproduce a word, and utilizing the redundancies of experience.

ITPA Subtests

The subtests of the ITPA which were generated from the above model tap discrete functions which are incorporated in the three dimensions just discussed. Each utilizes a channel, a level, and a process. It will be noted from the model that the following functions, each of which is tested by a separate subtest of the ITPA, occur at discrete intersections of the three dimensions described above.

1. Auditory Reception (the ability to understand auditory symbols such as verbal discourse) is represented at the intersection of the receptive process, the auditory-vocal channel, and the representational level.
2. Visual Reception (the ability to gain meaning from visual symbols) is represented at the intersection of the receptive process, the visual-motor channel, and the representational level.
3. Auditory Association (the ability to relate concepts presented orally) is represented at the intersection of the organizing process, the auditory-vocal channel, and the representational level.
4. Visual Association (the ability to relate concepts presented visually) is represented at the intersection of the organizing process, the visual-motor channel, and the representational level.
5. Verbal Expression (the ability to express concepts verbally, i.e., vocally) is represented at the intersection of the expressive process, the auditory-vocal channel, and the representational level.
6. Manual Expression (the ability to express ideas manually) is represented at the intersection of the expressive process, the visual-motor channel, and the representational level.
7. Grammatic Closure (the ability to make use of the redundancies of oral language in acquiring automatic habits for

handling syntax and grammatic inflections) is represented at the intersection of the organizing process, the auditory-vocal channel, and the automatic level. The two supplementary tests of Auditory Closure and Sound Blending also fall at this intersection.

8. Visual Closure (the ability to identify a common object from an incomplete visual presentation) is represented at the intersection of the organizing process, the visual-motor channel, and the automatic level.

9. Auditory Sequential Memory (the ability to reproduce from memory sequences of digits of increasing length) is represented at the intersection of the organizing process, the auditory-vocal channel, and the automatic level.

10. Visual Sequential Memory (the ability to reproduce sequences of nonmeaningful figures from memory) is represented at the intersection of the organizing process, the visual-motor channel, and the automatic level.

Supplementary Subtests

1. Auditory Closure (the ability to fill in missing parts which are deleted in an auditory presentation and to produce a complete word) is a test of the organizing process at the automatic level.

2. Sound Blending (the ability to tell what a word is from sounds of a word spoken singly at half-second intervals) is

a test of the organizing process at the automatic level in the auditory-vocal channel.

APPENDIX C

TEACHER FOLLOW-UP QUESTIONNAIRE (1977)

The information requested below will aid us in determining the validity of various achievement and diagnostic tests which are utilized by school systems. Thank you for your assistance in completing this form. Please provide information requested below according to your district instructions.

Please PRINT CAREFULLY. Confidentiality ID Code (Teacher leave blank) ____________

Child's Name ____
last name first name initial

Sex ___M ___F Current Grade ____________ Date of Birth ___/___/___
month day year

Teacher's Name (optional) ______________________________

District ____________________________ School ______________

How is this child currently performing in these school skills? PLEASE PLACE NUMBER in BLANK.

Performing ABOVE age level = 1, performing AT age level = 3, performing BELOW age level = 5. Use a 2 for children SLIGHTLY ABOVE age level and 4 for children SLIGHTLY BELOW age level.

1. Word Reading ____
2. Sentence Reading ____
3. Reading Comprehension ____
4. Spelling ____
5. Receptive Language ____
6. Expressive Language ____
7. Math Computation ____
8. Math Concepts/Reasoning ____
9. Social Science ____
10. Science ____

PLEASE PLACE ONE OF THESE NUMBERS IN BLANKS BELOW (3 = Yes), (2 = No), (1 = Don't Know)

1. Has this child received special education diagnostic services (extra/non-routine)? ____
2. Has this child received special education teaching services? ____
3. Were any grades repeated? ____
4. Do you think this child should be referred for psychological and/or educational testing? ____
5. Has this child been found to have a vision problem? ____
6. Has this child been found to have a hearing problem? ____
7. Has this child been found to have an articulation problem? ____
8. Is this child physically handicapped? ____
9. Is this child bilingual? ____
10. Does this child's cultural background make for communication difficulties in the classroom? ____

Please CHECK ONE.

Child's current class placement:

Regular classroom ___ (1)
Open space classroom ___ (2)
Special Education class
(for selected subject areas only) ___ (3)
Special Education class
(full-time placement) ___ (4)

Ethnic membership of child:

American Indian Culture ___ (1)
Black Culture ___ (2)
Caucasian Culture ___ (3)
Oriental Culture ___ (4)
Spanish-American Culture ___ (5)
Other ___ (6)
Don't Know ___ (7)

Please list the most current achievement test information. Please list scores for all subtests and totals when available, e.g. (Word Recognition, Total Reading, Total Battery)

Full name of test ______________________ Form and/or level __________

Date of Administration ___/___ (month year) Teacher scored ___ (check) Computer scored ___ (check)

CHECK type of score given: Standard Score ___, Raw Score ___, GSV ___,

Percentile ___, Other (Indicate) ______________

Standard or Raw Scores are preferred. PLEASE be consistent throughout the district. If scores other than Standard or Raw scores are given, put a line through "Raw Score" under the subtest name and indicate type of score above.

Subtest Name		Subtest Name		Subtest Name		Subtest Name	
Raw Score	Standard	Raw Score	Standard	Raw Score	Standard	Raw Score	Standard

Subtest Name		Subtest Name		Subtest Name		Subtest Name	
Raw Score	Standard	Raw Score	Standard	Raw Score	Standard	Raw Score	Standard

Subtest Name		Subtest Name		Subtest Name		Subtest Name	
Raw Score	Standard	Raw Score	Standard	Raw Score	Standard	Raw Score	Standard

APPENDIX D

SCREEN MEAN PROFILES BY CLUSTER DESIGNATION FOR THE KINDERGARTEN SAMPLE

Age: 75.33 Months	Females: N = 4	Regular Class: N = 9*
N = 9, 2.40% of Sample	Males: N = 5	Open Space: N = 0

Significant Below Average Performance (LSDMOD, p <.05):

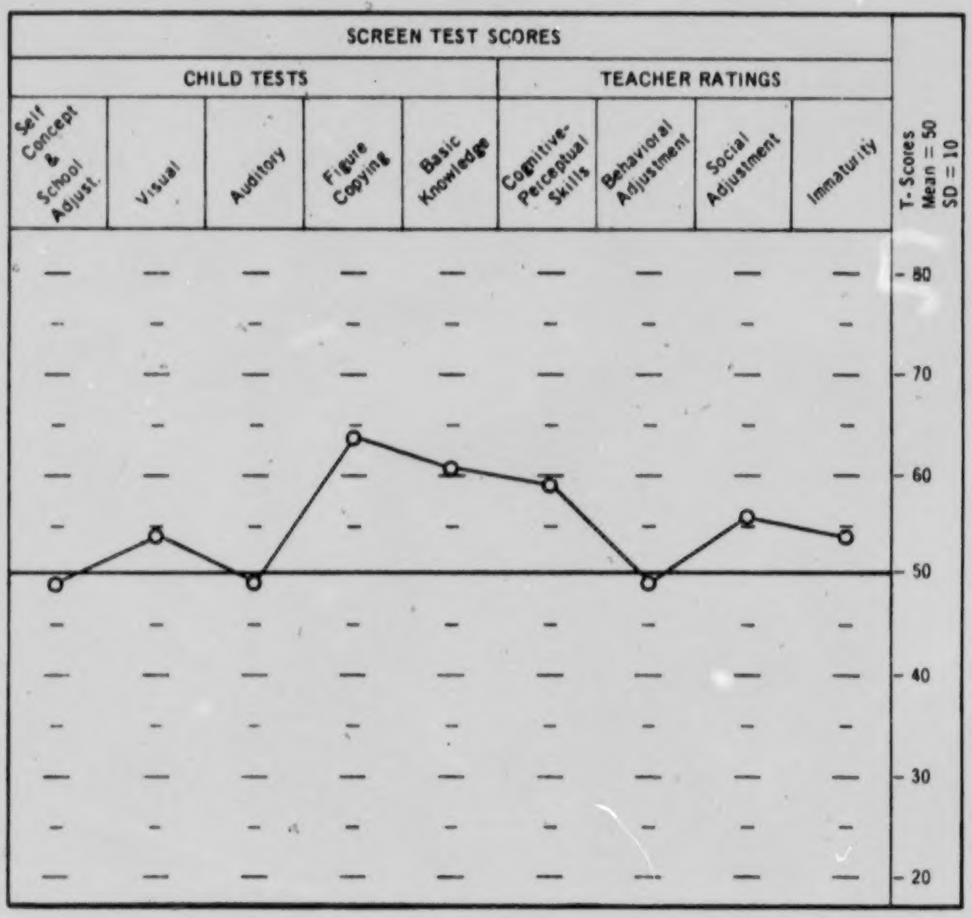

Figure 1. Cluster 7--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Gra. Cl.	(33, 30 to 37)
WISC:	(M-%tile, 95% Conf. Int.)
Verbal IQ	(92-IQ, 81-IQ to 104-IQ)
VMI:	Yes

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(37th, 25th to 49th)
Read. Rec.	(41st, 29th to 52nd)
Spelling	(41st, 31st to 49th)
Gen. Inf.	(34th, 18th to 52nd)
Total	(29th, 20th to 41st)

Phonetics: L & S Vowels

Age: 76.78 Months Females: N = 0* Regular Class: N = 5
N = 9, 2.40% of Sample Males: N = 9 Open Space: N = 4

Significant Below Average Performance (LSDMOD, $p < .05$):

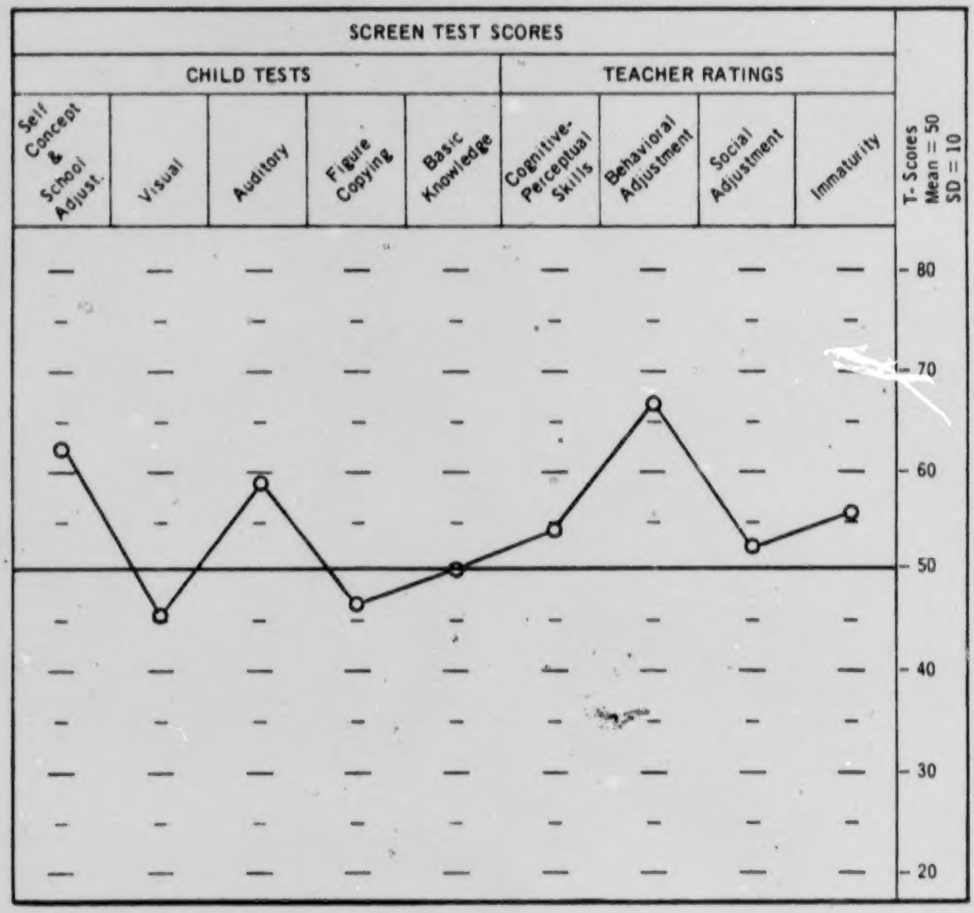

Figure 2. Cluster 12--SCREEN Mean Profile (Kindergarten)

ITPA: None

WISC: None

VMI: No

PIAT: (M-%tile, 95% Conf. Int.)
Spelling (34th, 21st to 49th)

Phonetics: None

Age: 74.13 Months
N = 30, 8.00% of Sample

Females: N = 6*
Males: N = 24

Regular Class: N = 28*
Open Space: N = 2

Significant Below Average Performance (LSDMOD, $p < .05$):

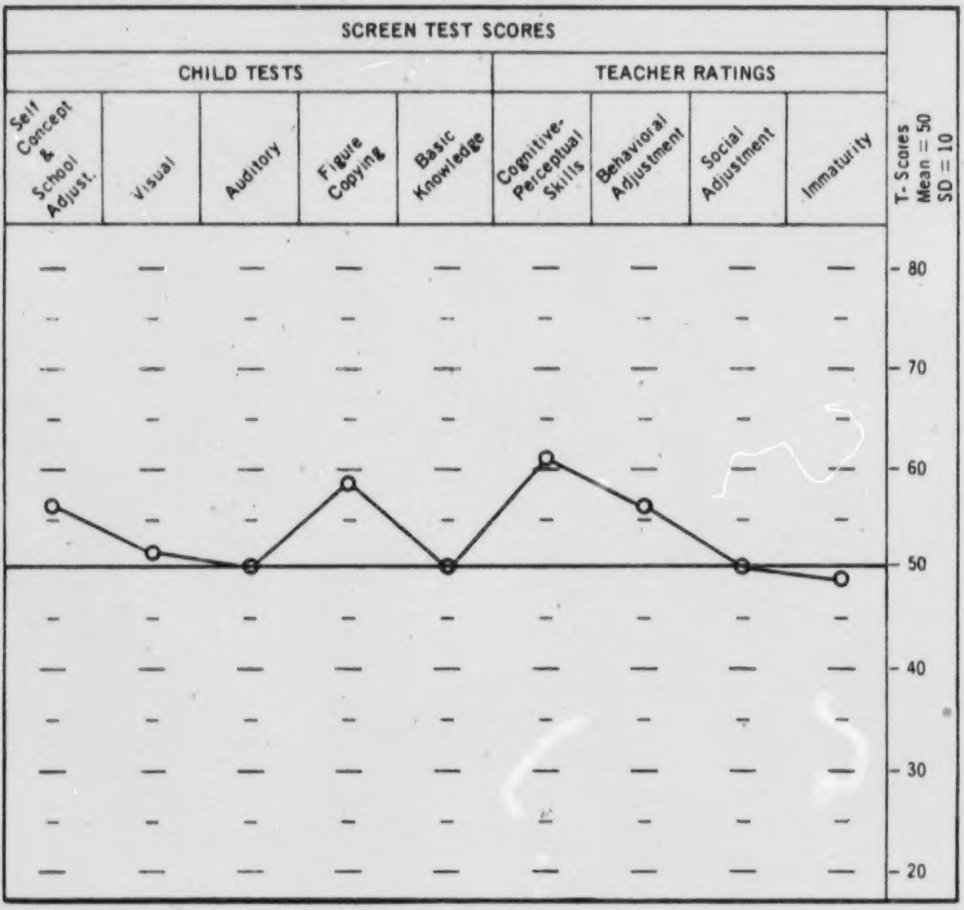

Figure 3. Cluster 13--SCREEN Mean Profile (Kindergarten)

ITPA: None

WISC:	(M-%tile, 95% Conf. Int.)
Dig. Span	(24th, 16th to 37th)
Verbal IQ	(94-IQ, 89-IQ to 99-IQ)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(40th, 29th to 49th)
Read. Rec.	(41st, 36th to 49th)
Spelling	(42nd, 36th to 47th)
Gen. Inf.	(41st, 29th to 50th)
Total	(35th, 27th to 44th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Total

Age: 71.25 Months
N = 8, 2.10% of Sample

Females: N = 3
Males: N = 5

Regular Class: N = 5
Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

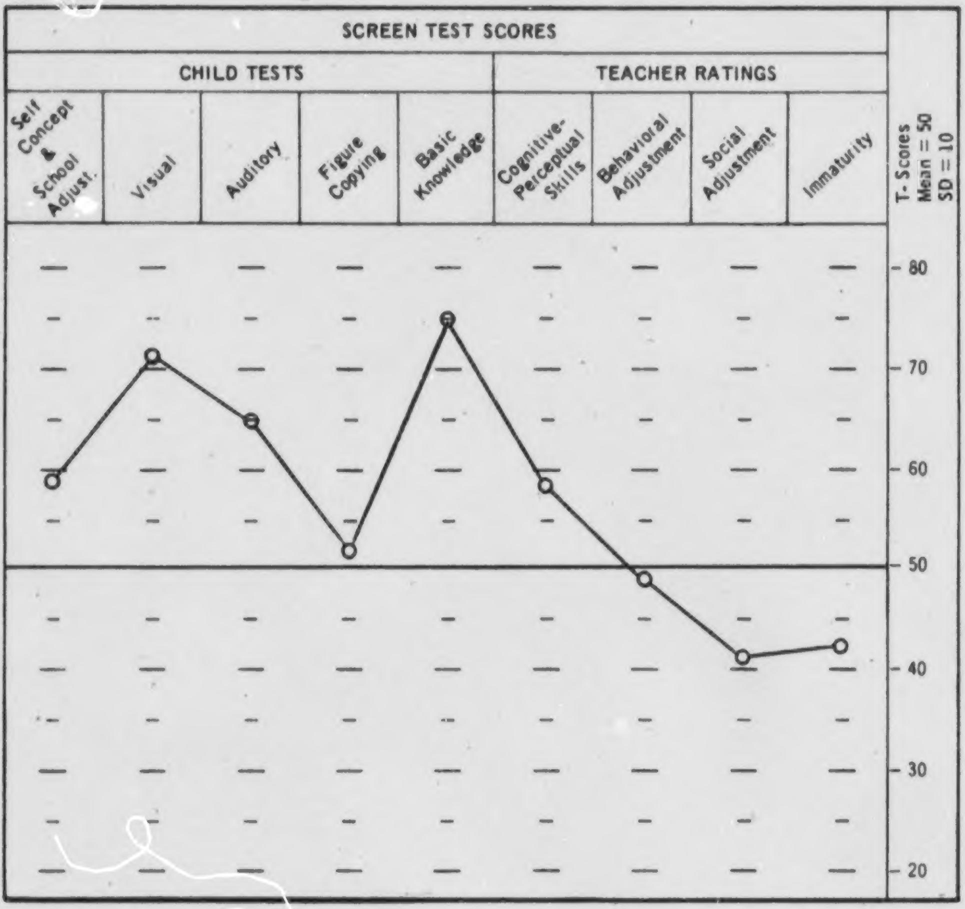

Figure 4. Cluster 15--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(29, 26 to 33)
Aud. Rec.	(31, 27 to 35)
Vis. As.	(31, 27 to 35)
Gra. Cl.	(29, 25 to 33)
Aud. Cl.	(30, 27 to 34)
PLQ	(90, 84 to 95)

WISC:	(M-%tile, 95% Conf. Int.)
Dig. Span	(16th, 5th to 37th)
Verbal IQ	(87-IQ, 81-IQ to 94-IQ)

VMI: Yes

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(23rd, 5th to 30th)
Read. Rec.	(23rd, 8th to 44th)
Spelling	(23rd, 15th to 34th)
Gen. Inf.	(25th, 9th to 47th)
Total	(15th, 6th to 24th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Total

Age:	76.28 Months	Females:	N = 8	Regular Class:	N = 13
N = 25, 6.60% of Sample		Males:	N = 17	Open Space:	N = 12

Significant Below Average Performance (LSDMOD, $p < .05$):

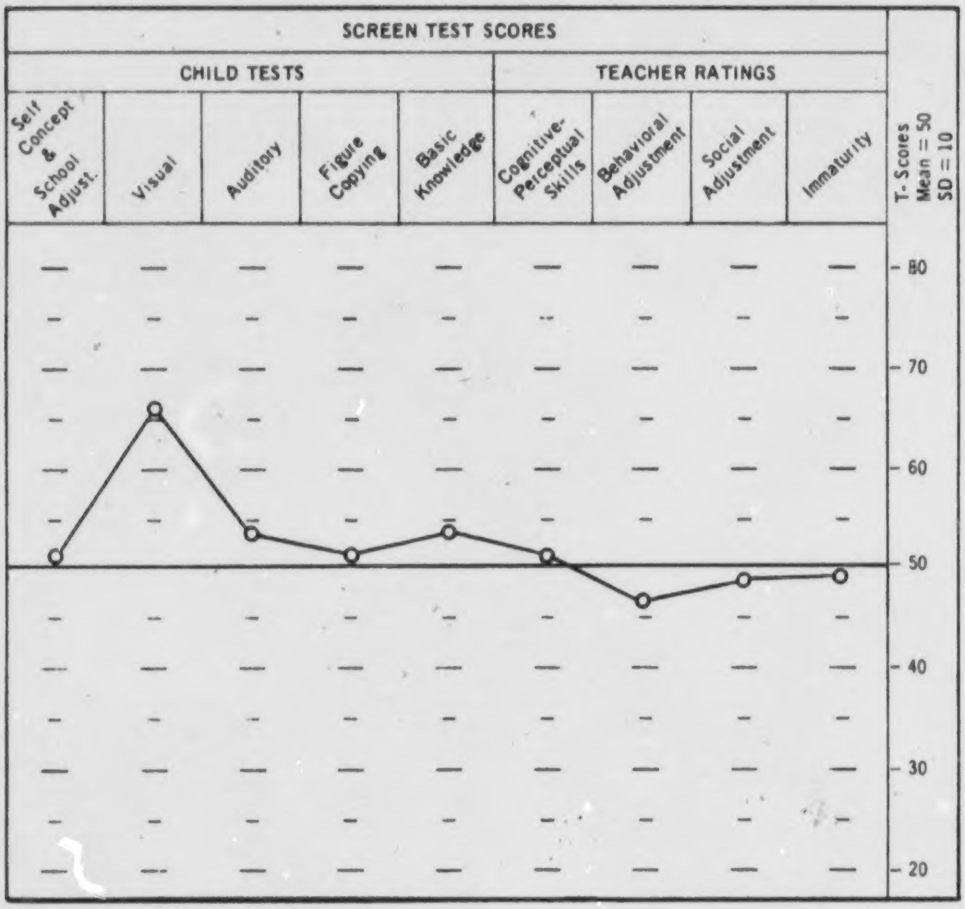

Figure 5. Cluster 16 Plus Cluster 18--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. Cl.	(32, 29 to 35)
PLQ	(97, 93 to 101)

WISC:	(M-%tile, 95% Conf. Int.)
Verbal IQ	(92-IQ, 87-IQ to 97-IQ)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(29th, 23rd to 36th)
Read. Rec.	(41st, 31st to 49th)
Spelling	(36th, 30th to 44th)
Gen. Inf.	(34th, 25th to 44th)
Total	(29th, 23rd to 37th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.

Age: 75.94 Months Females: N = 7 Regular Class: N = 12
N = 18, 4.80% of Sample Males: N = 11 Open Space: N = 6

Significant Below Average Performance (LSDMOD, $p < .05$):

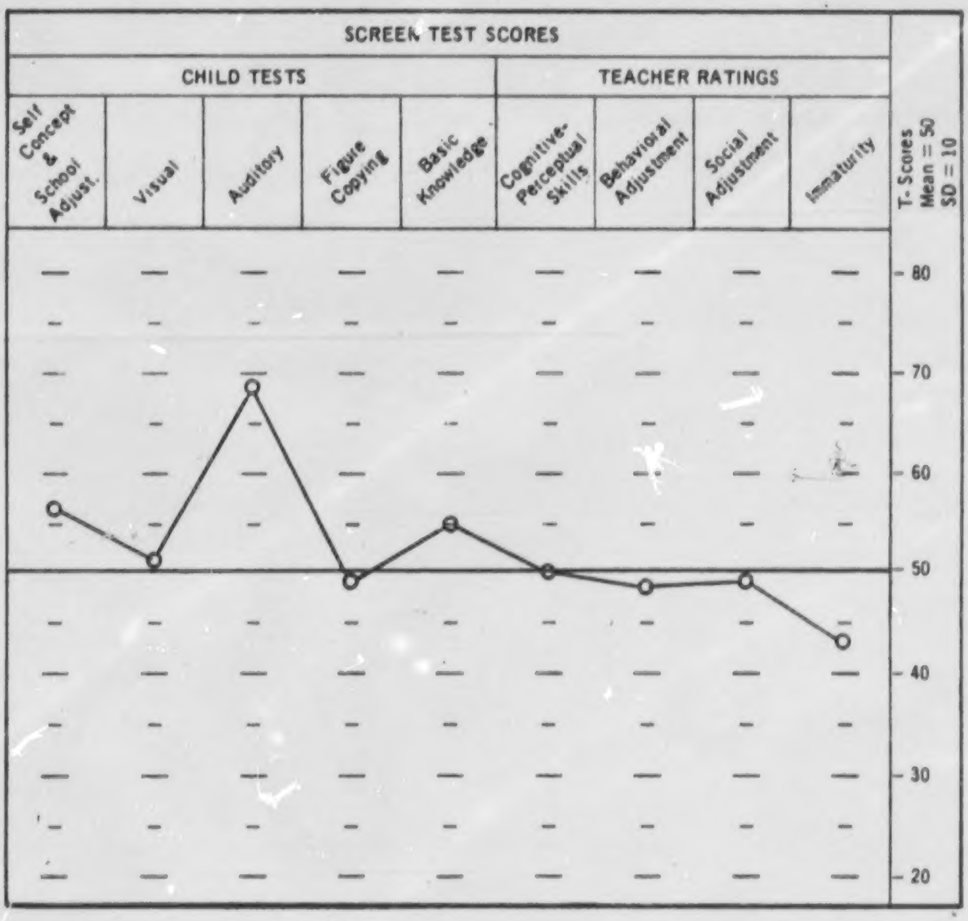

Figure 6. Cluster 17--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(32, 29 to 35)
Vis. S. M.	(31, 27 to 34)
Gra. Cl.	(32, 29 to 35)
PLQ	(95, 90 to 99)

WISC:	(M-%tile, 95% Conf. Int.)
Dig. Span	(24th, 16th to 50th)
Verbal IQ	(92-IQ, 84-IQ to 100-IQ)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(36th, 25th to 49th)
Gen. Inf.	(36th, 23rd to 49th)
Total	(38th, 26th to 49th)

Phonetics: Init. Cons.
Final Cons.

Age: 73.59 Months   Females: N = 7   Regular Class: N = 10
N = 17, 4.5% of Sample   Males: N = 10   Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

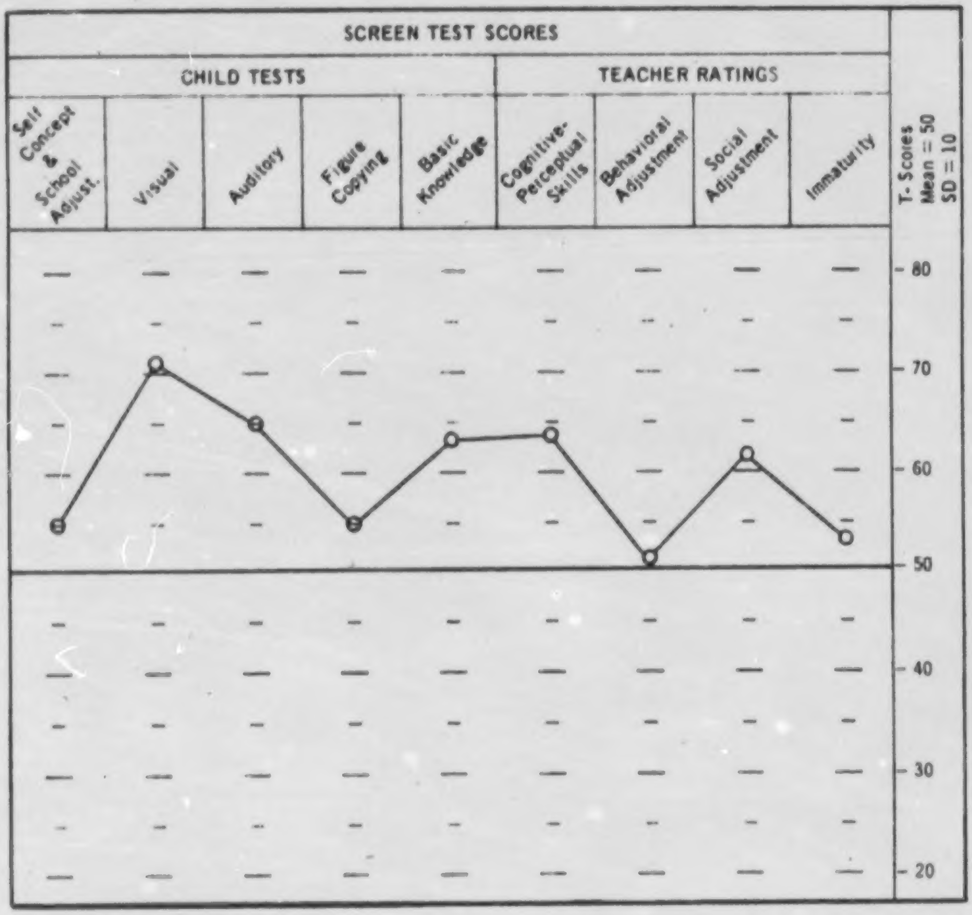

Figure 7. Cluster 21--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(31, 28 to 34)
Aud. Rec.	(33, 29 to 36)
Vis. S. M.	(31, 29 to 34)
Gra. Cl.	(30, 27 to 32)
Aud. Cl.	(30, 26 to 34)
Sd. Bl.	(34, 30 to 37)
PLQ	(92, 88 to 97)

WISC:	(M-%tile, 95% Conf. Int.)
Dig. Span	(24th, 16th to 37th)
Verbal IQ	(89-IQ, 84-IQ to 94-IQ)

VMI: Yes

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(31st, 24th to 41st)
Read. Rec.	(38th, 24th to 52nd)
Spelling	(36th, 25th to 49th)
Gen. Inf.	(29th, 19th to 41st)
Total	(27th, 18th to 39th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 76.45 Months · Females: N = 24 · Regular Class: N = 37
N = 51, 13.60% of Sample · Males: N = 27 · Open Space: N = 14

Significant Above Average Performance (LSDMOD, $p < .05$):

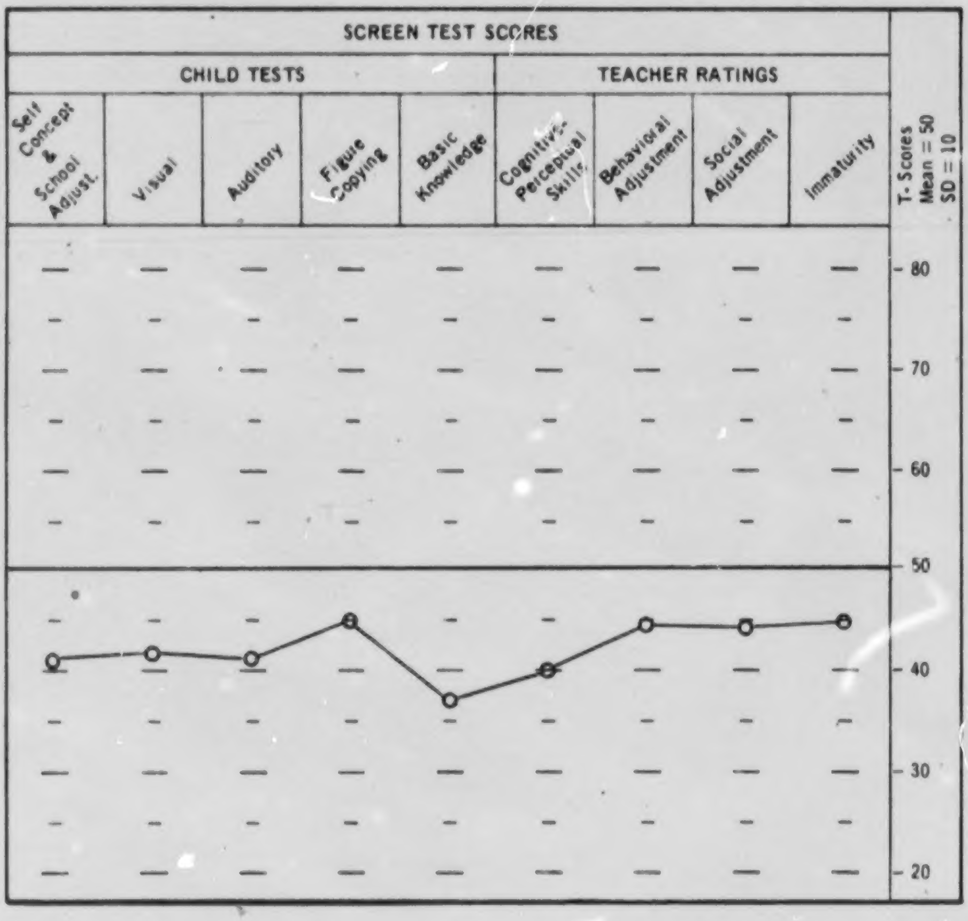

Figure 8. Cluster 4--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(44, 42 to 45)
Aud. Rec.	(41, 31 to 42)
Vis. S. M.	(40, 38 to 42)
Vis. As.	(41, 39 to 42)
Gra. Cl.	(42, 40 to 44)
Aud. Cl.	(39, 38 to 41)
Sd. Bl.	(49, 46 to 51)
PLQ	(113, 110 to 117)

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(71st, 62nd to 75th)
Read. Rec.	(77th, 69th to 82nd)
Gen. Inf.	(74th, 67th to 80th)
Total	(73rd, 66th to 79th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Cons. Blends
Total

WISC:	(M-%tile, 95% Conf. Int.)
Dig. Span	(63rd, 63rd to 75th)
Verbal IQ	(111-IQ, 108-IQ to 115-IQ)

VMI: Yes

Age: 76.00 Months
N = 6, 1.60% of Sample

Females: N = 2
Males: N = 4

Regular Class: N = 3
Open Space: N = 3

Significant Above Average Performance (LSDMOD, $p < .05$):

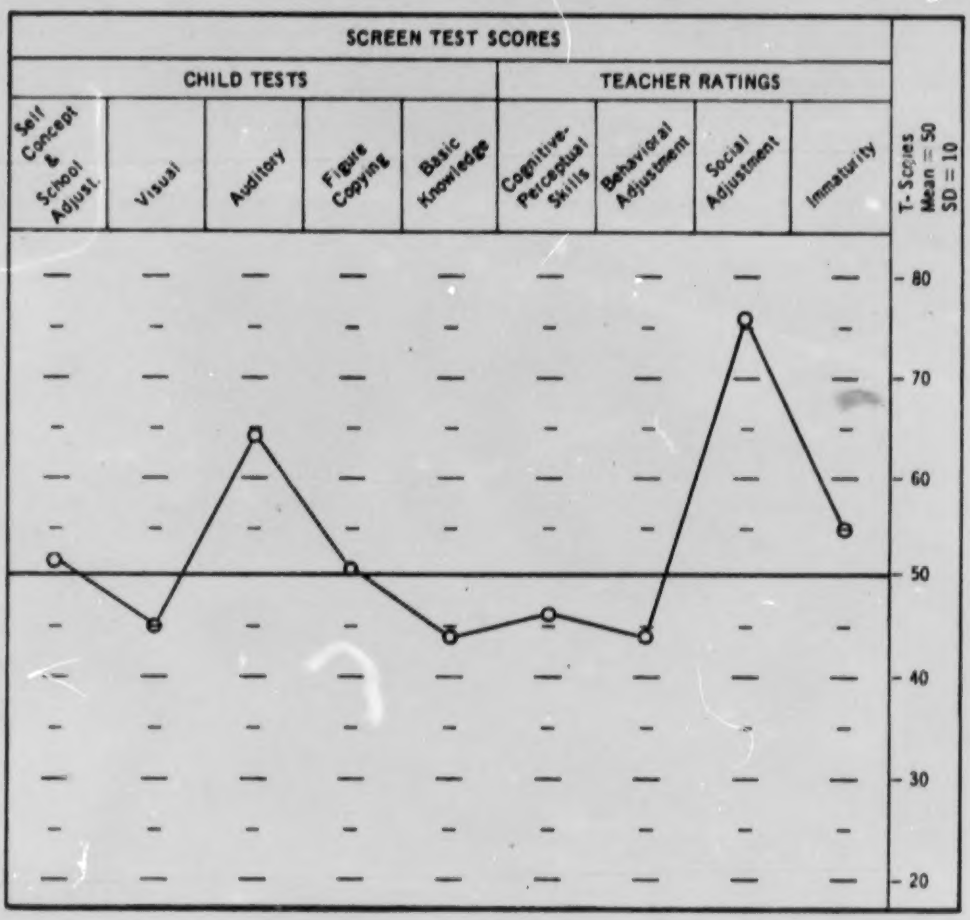

Figure 9. Cluster 5--SCREEN Mean Profile (Kindergarten)

ITPA: None

WISC: None

VMI: Yes

PIAT: (M-%tile, 95% Conf. Int.)
Read. Rec. (74th, 40th to 95th)

Phonetics: None

Age: 75.55 Months
N = 11, 2.90% of Sample

Females: N = 1*
Males: N = 10

Regular Class: N = 7
Open Space: N = 4

Significant Above Average Performance (LSDMOD, $p < .05$):

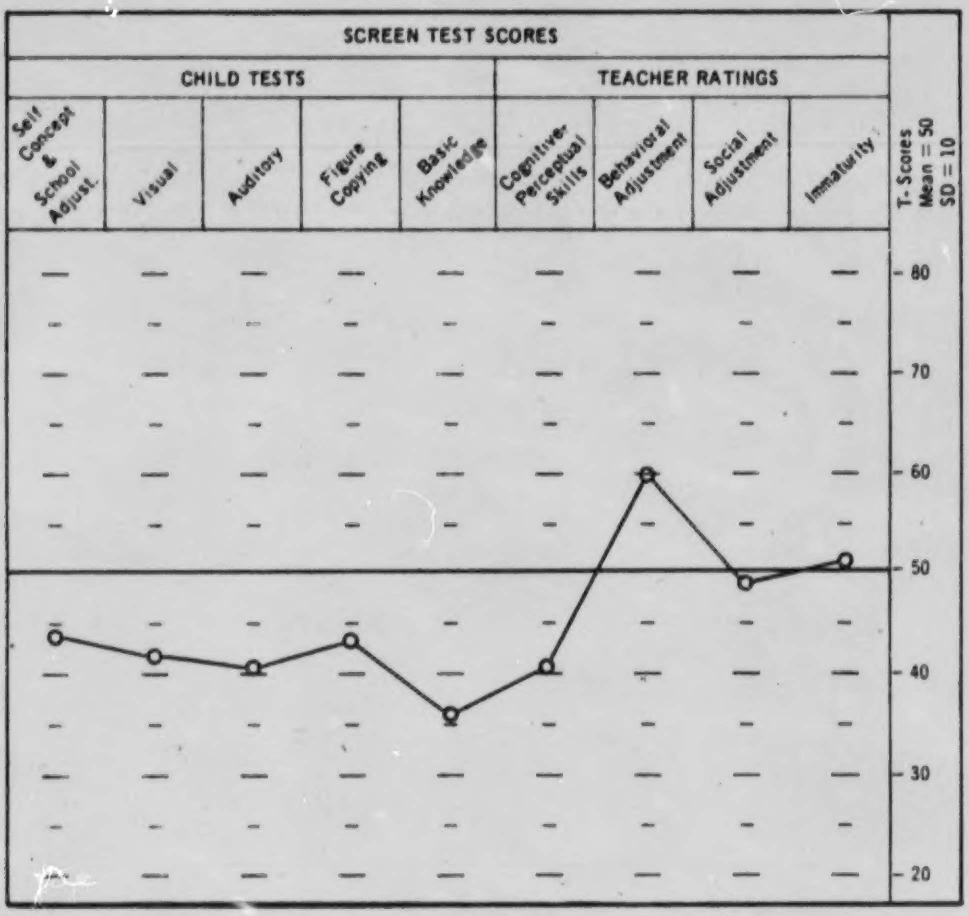

Figure 10. Cluster 3--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(44, 42 to 47)
Aud. Rec.	(45, 41 to 50)
Vis. As.	(47, 44 to 51)
Gra. Cl.	(41, 36 to 47)
PLQ	(114, 107 to 122)

WISC: None

VMI: Yes

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(80th, 72nd to 87th)
Read. Rec.	(72nd, 50th to 85th)
Spelling	(69th, 48th to 84th)
Gen. Inf.	(69th, 58th to 78th)
Total	(73rd, 56th to 86th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 75.50 Months Females: N = 2* Regular Class: N = 9*
N = 10, 2.70% of Sample Males: N = 8 Open Space: N = 1

Significant Above Average Performance (LSDMOD, $p < .05$):

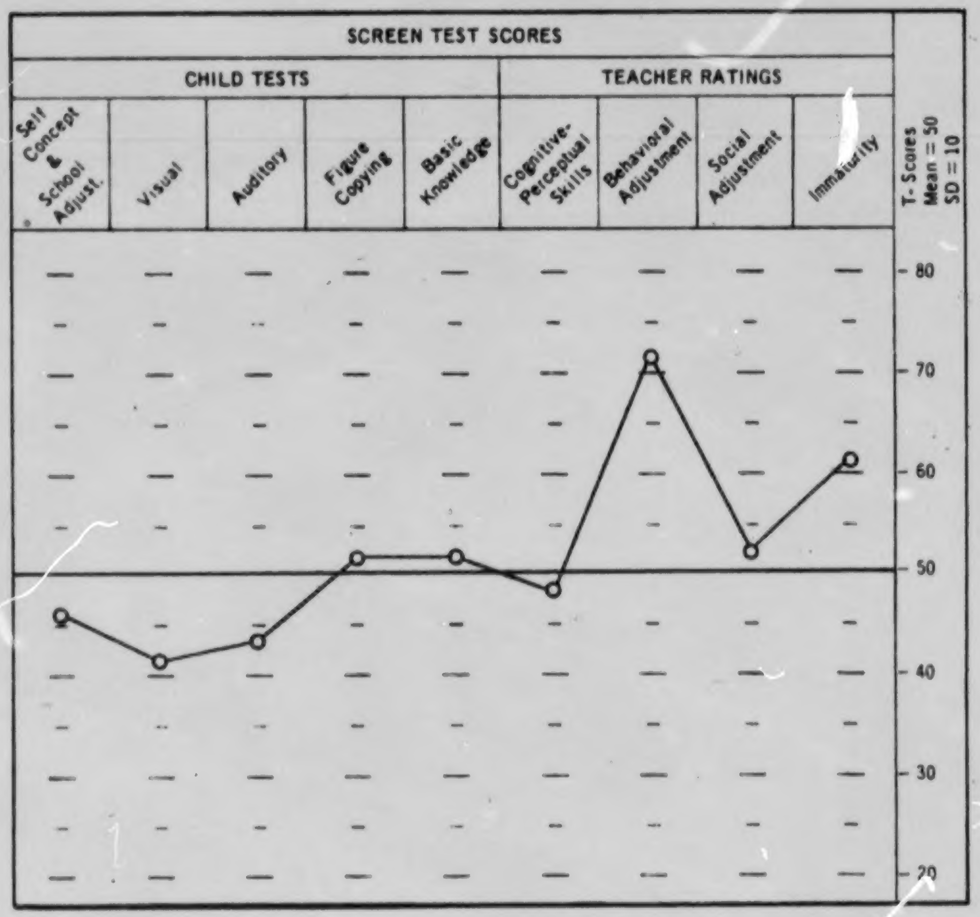

Figure 11. Cluster 10--SCREEN Mean Profile (Kindergarten)

ITPA: (M-S.S., 95% Conf. Int.)
Gra. Cl. (41, 36 to 46)
Aud. Cl. (40, 37 to 44)
PIQ (111, 102 to 119)

PIAT: (M-%tile, 95% Conf. Int.)
Gen. Inf. (75th, 61st to 86th)

Phonetics: Cons. Blends

WISC: None

VMI: No

Age: 74.15 Months
N = 20, 5.30% of Sample

Females: N = 12
Males: N = 8

Regular Class: N = 13
Open Space: N = 7

Significant Above Average Performance (LSDMOD, $p < .05$):

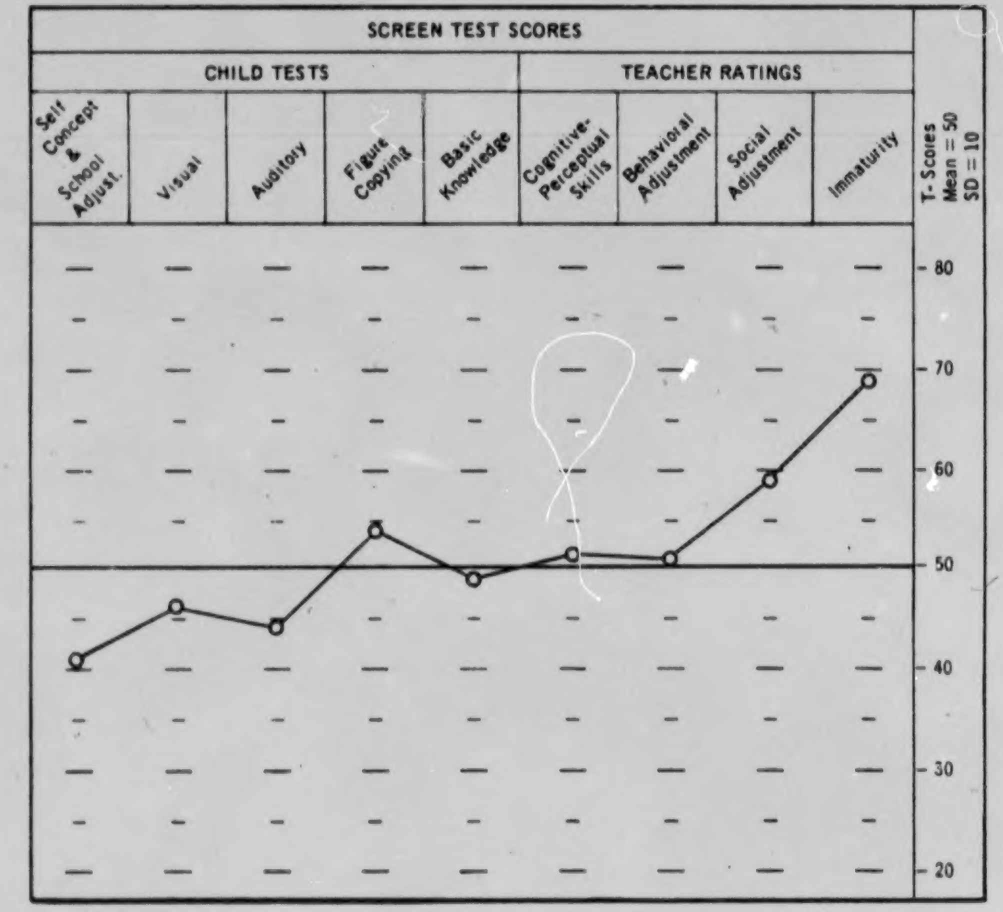

Figure 12. Cluster 6 Plus Cluster 8--Mean SCREEN Profile (Kindergarten)

ITPA: (M-S.S., 95% Conf. Int.)
Aud. As. (41, 39 to 43)
Sd. Bl. (48, 43 to 53)

PIAT: None

Phonetics: None

WISC: None

VMI: No

Age: 74.71 Months
N = 7, 1.90% of Sample

Females: N = 2*
Males: N = 5

Regular Class: N = 4
Open Space: N = 3

Significant Below* and Above** Average Performance (LSDMOD, p <.05):

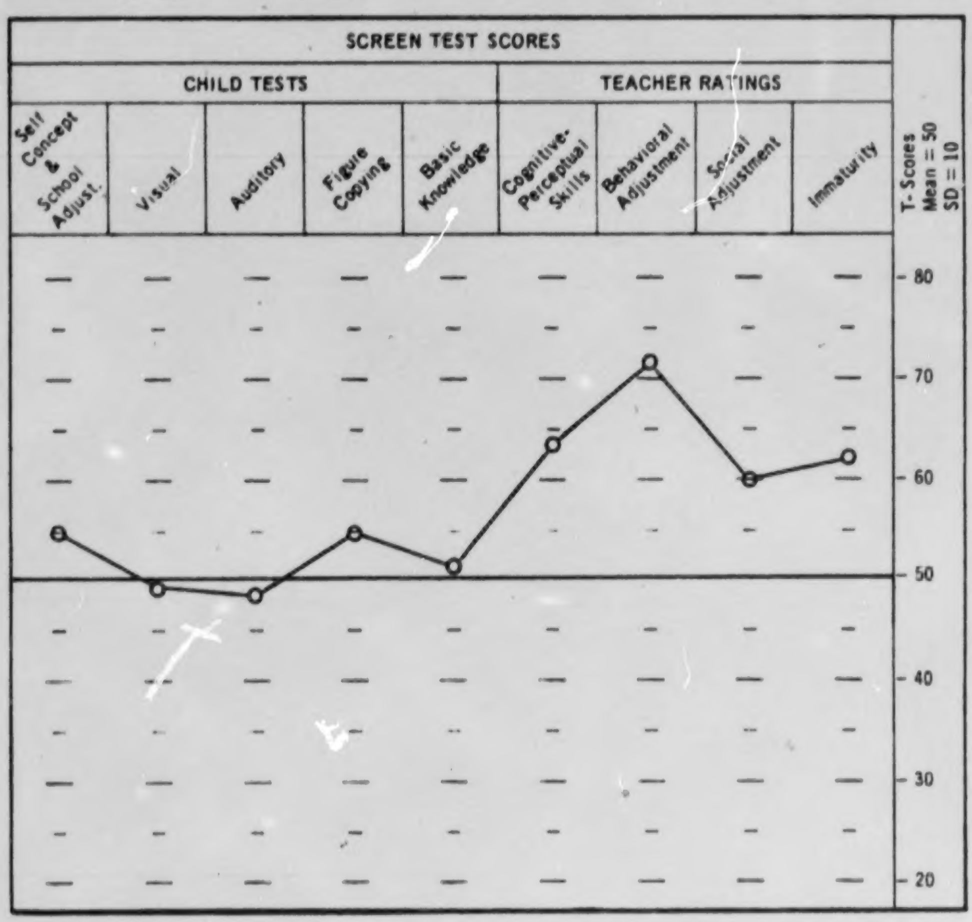

Figure 13. Cluster 11--SCREEN Mean Profile (Kindergarten)

ITPA**:	(M-S.S., 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Aud. As.	(41, 40 to 43)	Math	(31st, 14th to 52nd)*
PLQ	(112, 94 to 131)	Total	(39th, 18th to 62nd)*,**

WISC: None

Phonetics**: Init. Cons.
Final Cons.

VMI: No

Age:	74.02 Months	Females:	N = 14	Regular Class:	N = 36*
N = 43, 11.40% of Sample		Males:	N = 29	Open Space:	N = 7

Significant Above Average Performance (LSDMOD, $p < .05$):

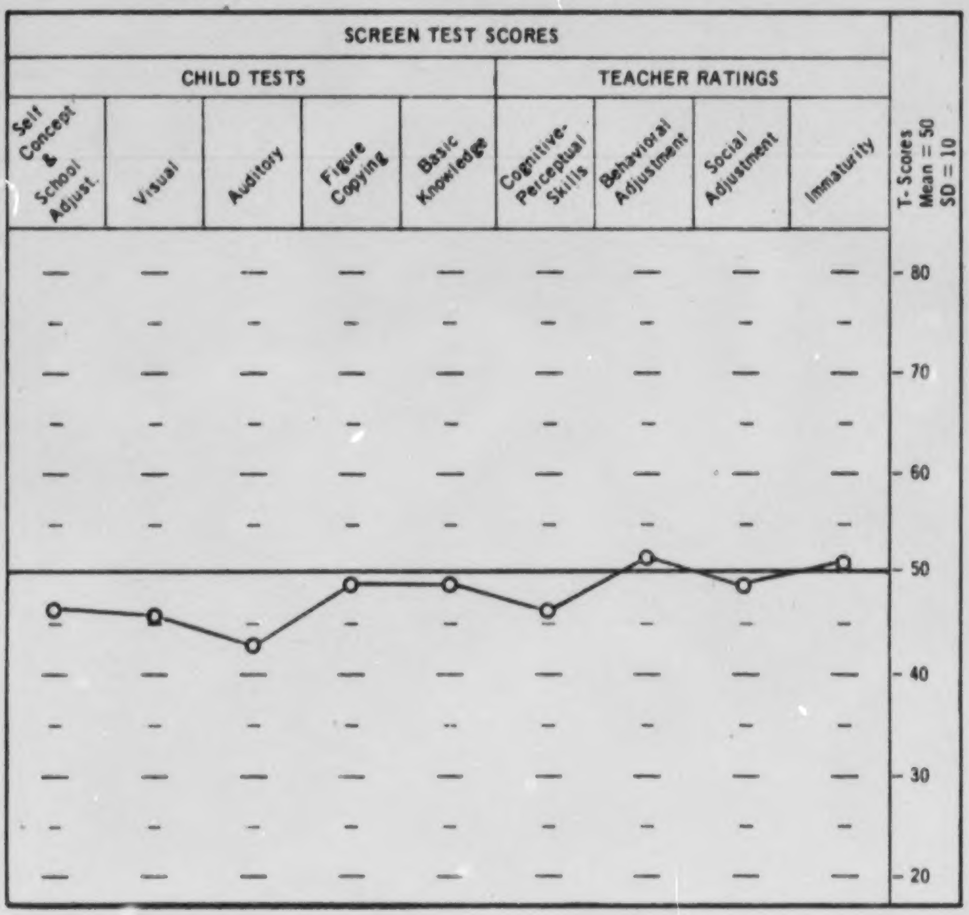

Figure 14. Cluster 9--SCREEN Mean Profile (Kindergarten)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(41, 39 to 43)
Vis. As.	(40, 39 to 42)
Gra. Cl.	(40, 38 to 42)
Aud. Cl.	(38, 37 to 40)
Sd. Bl.	(47, 44 to 51)

WISC: None

PIAT:	(M-%tile, 95% Conf. Int.)
Read. Rec.	(69th, 61st to 75th)
Spelling	(61st, 53rd to 69th)

Phonetics: None

VMI: No

Age: 73.91 Months
N = 53, 14.10% of Sample

Females: N = 20
Males: N = 33

Regular Class: N = 33
Open Space: N = 20

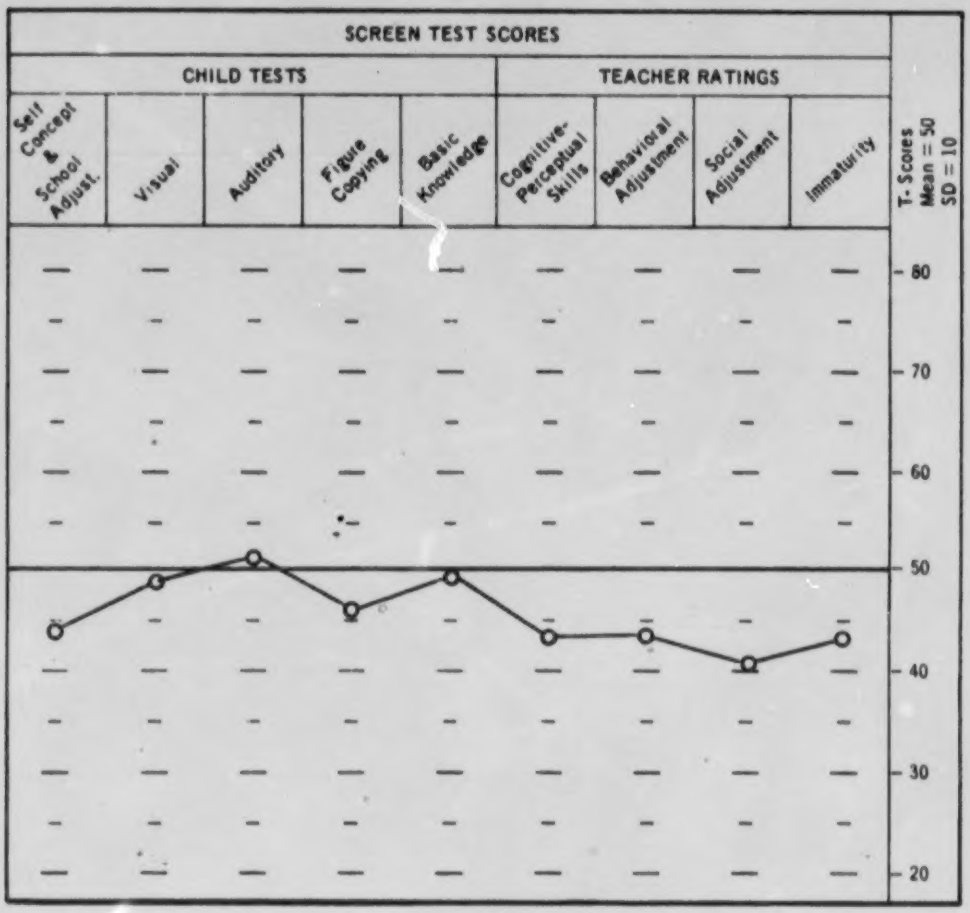

Figure 15. Cluster 1--SCREEN Mean Profile (Kindergarten)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

Age: 72.26 Months
N = 23, 6.10% of Sample

Females: N = 7
Males: N = 16

Regular Class: N = 13
Open Space: N = 10

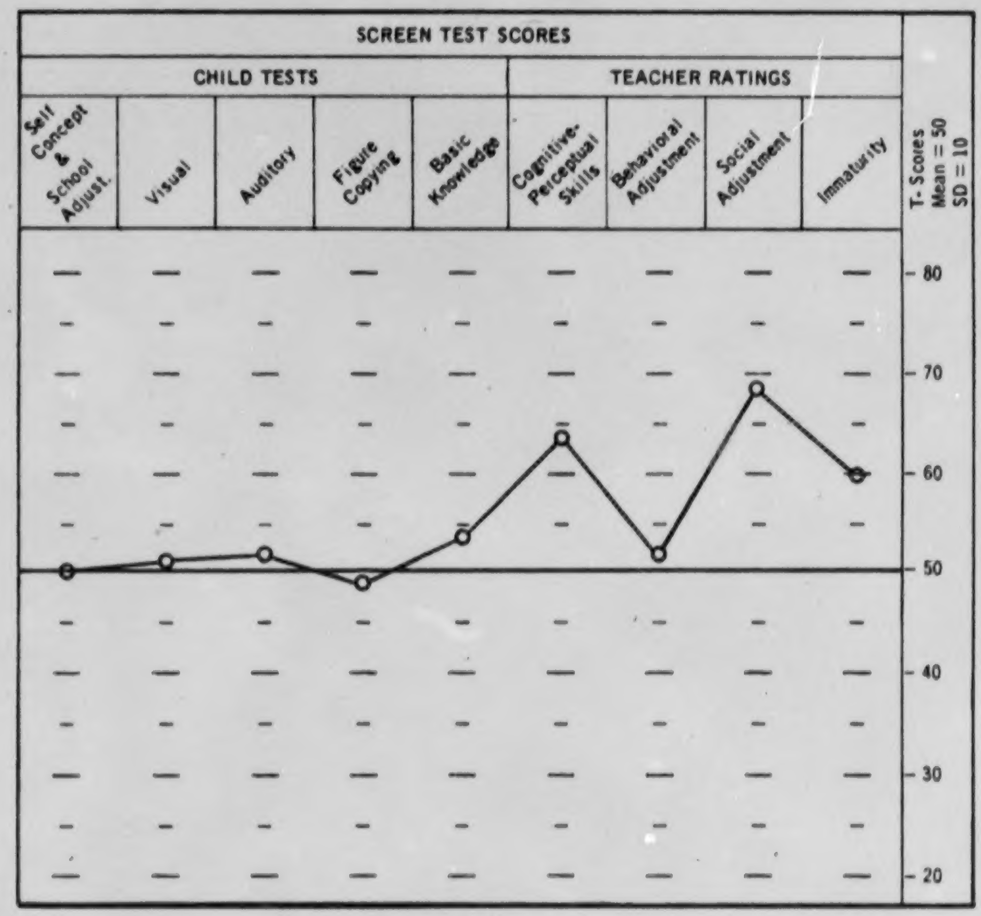

Figure 16. Cluster 14--SCREEN Mean Profile (Kindergarten)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

Age: 75.43 Months
N = 23, 6.10% of Sample

Females: N = 11
Males: N = 12

Regular Class: N = 17
Open Space: N = 6

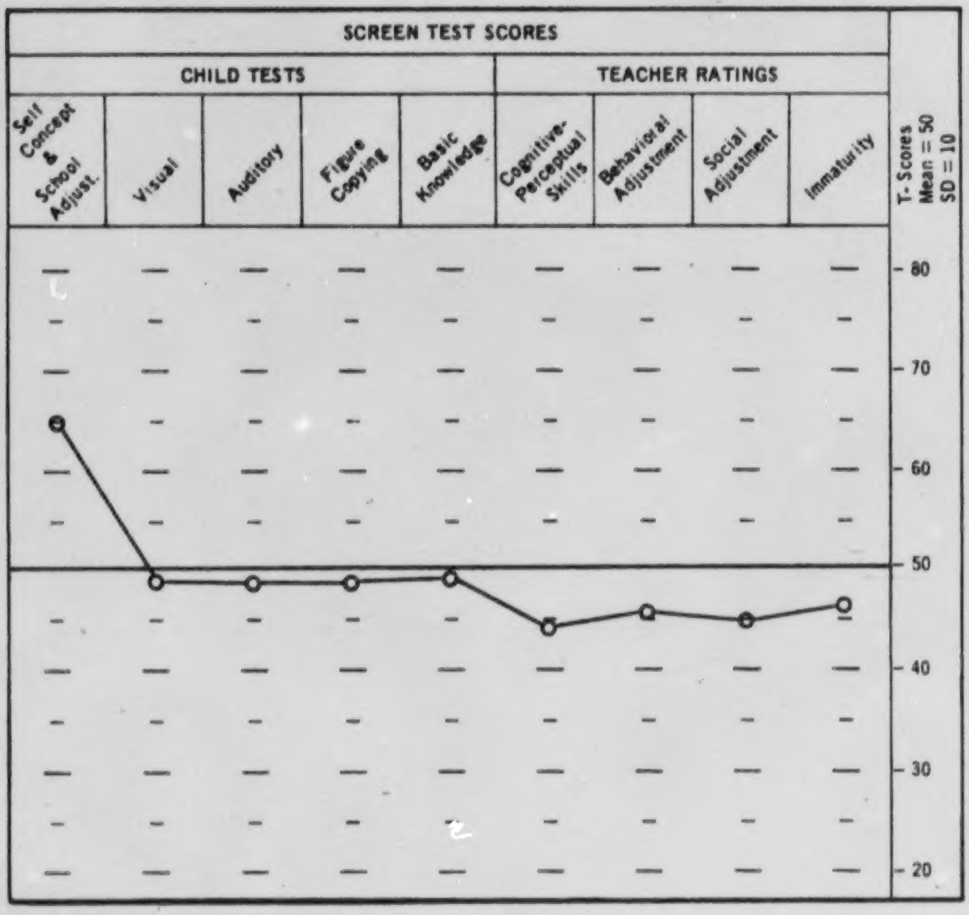

Figure 17. Cluster 2 Plus Cluster 20--SCREEN Mean Profile (Kindergarten)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

Age:	72:84 Months	Females:	N = 4	Regular Class:	N 10
N = 13, 3.50% of Sample		Males:	N = 9	Open Space:	N 3

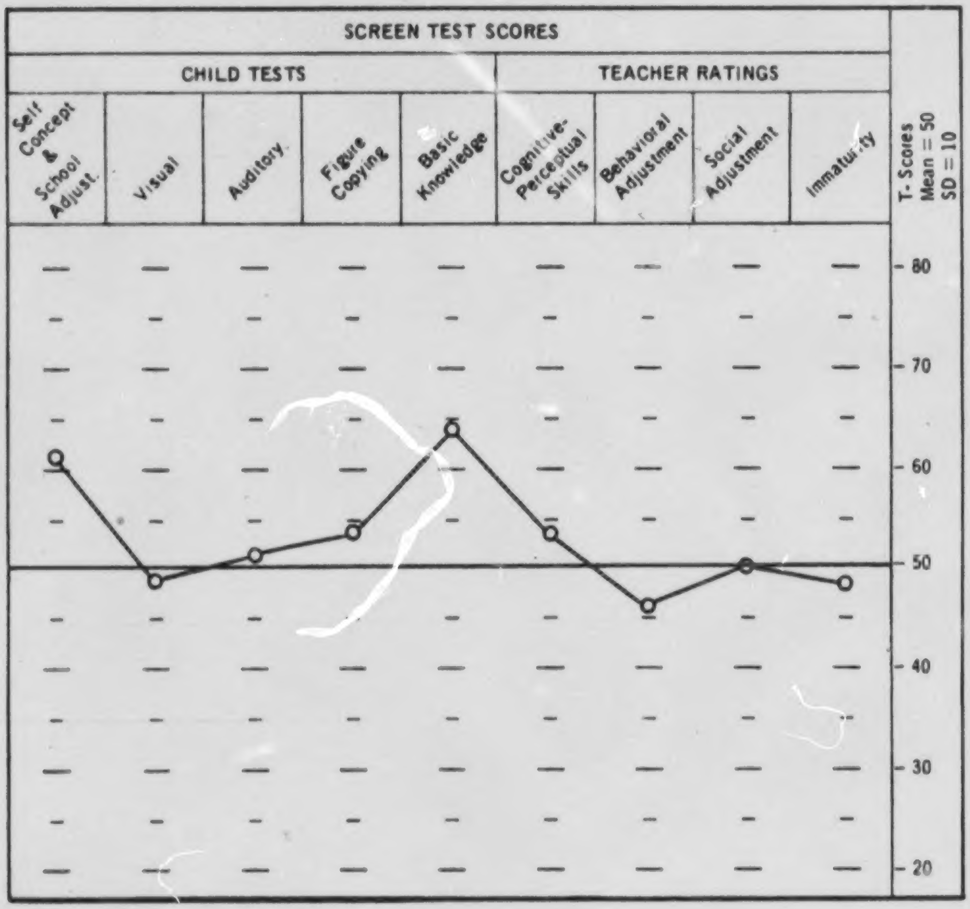

Figure 18. Cluster 19--SCREEN Mean Profile (Kindergarten)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

APPENDIX E

SCREEN MEAN PROFILES BY CLUSTER DESIGNATION FOR THE FIRST GRADE SAMPLE

Age: 86.33 Months
N = 6, 1.50% of Sample

Females: N = 1*
Males: N = 5

Regular Class: N = 3
Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

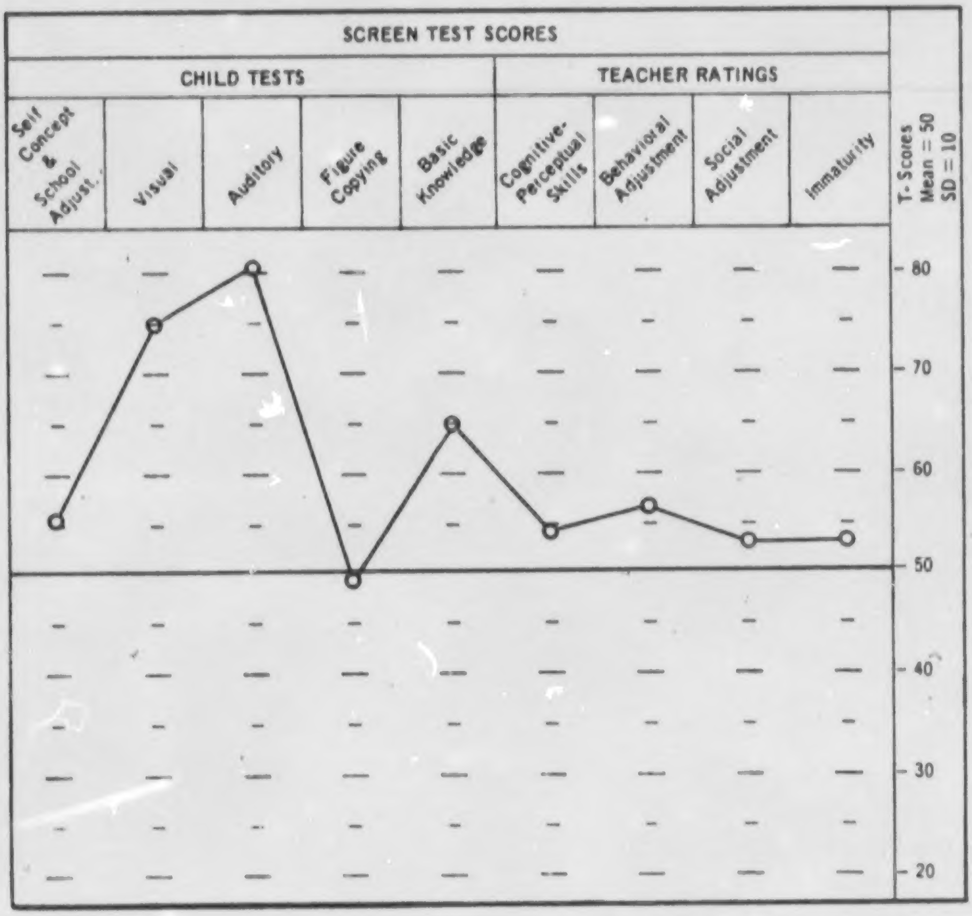

Figure 19. Cluster 6--SCREEN Mean Profile (First Grade)

ITPA: (M-S.S., 95% Conf. Int.)
PIQ (89, 70 to 109)

PIAT: (M-%tile, 95% Conf. Int.)
Math (13th, 1st to 44th)
Total (25th, 5th to 65th)

WISC: None

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Cons. Blends
Total

VMI: No

Age: 87.06 Months
N = 45, 11.60% of Sample

Females: N = 24*
Males: N = 21

Regular Class: N = 29
Open Space: N = 16

Significant Below Average Performance (LSDMOD, $p < .05$):

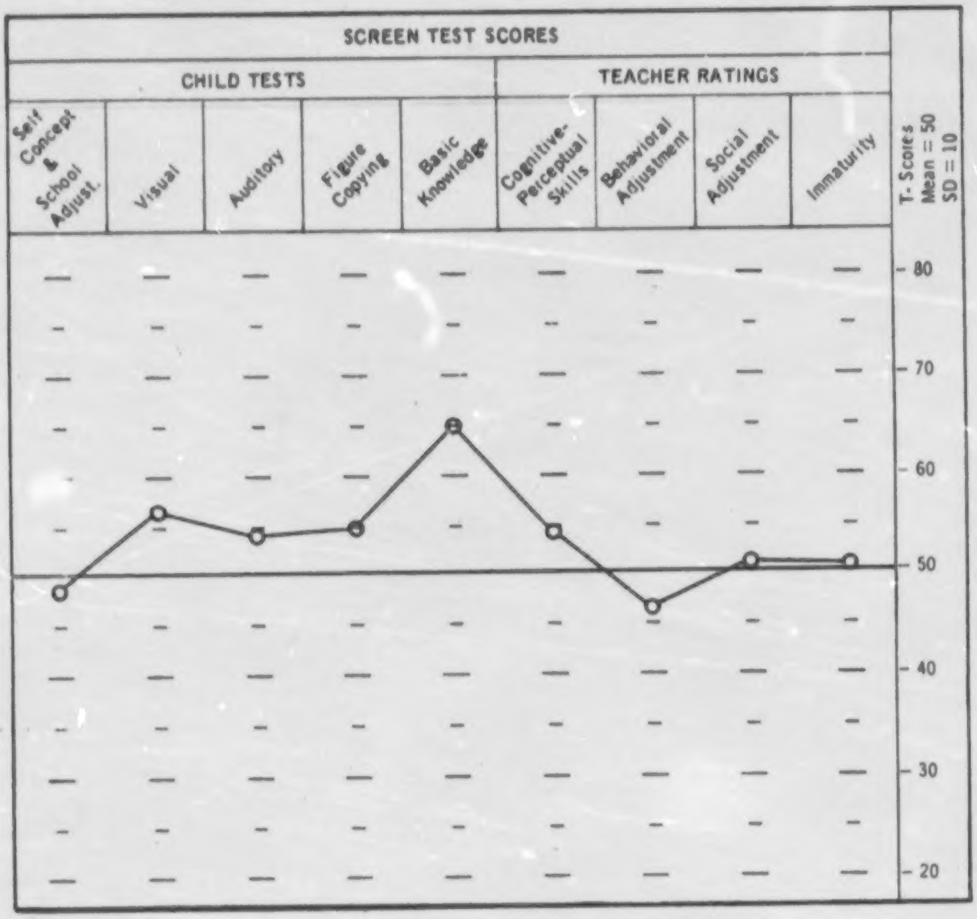

Figure 20. Cluster 7--SCREEN Mean Profile (First Grade)

ITPA:	(M-S.S., 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Vis. As.	(32, 31 to 34)	Math	(34th, 27th to 39th)

WISC: None

Phonetics: None

VMI: No

Age: 85.91 Months
N = 11, 2.80% of Sample

Females: N = 7*
Males: N = 2

Regular Class: N = 9
Open Space: N = 2

Significant Below Average Performance (LSDMOD, $p < .05$):

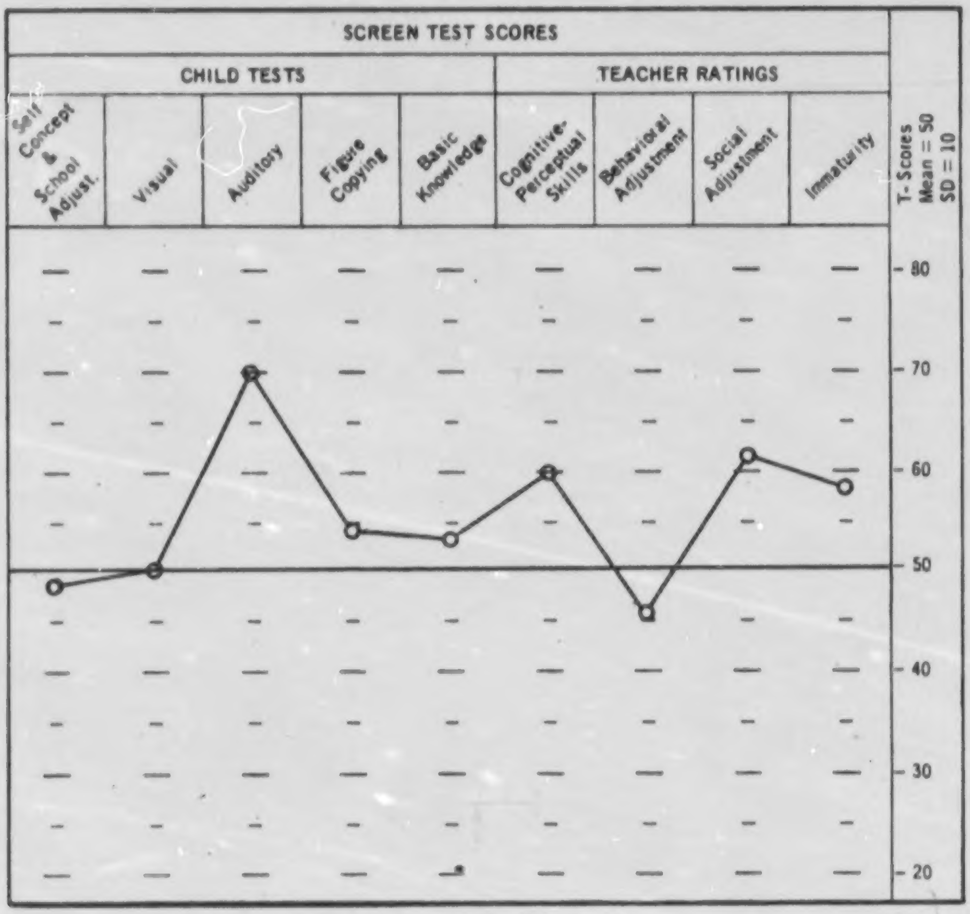

Figure 21. Cluster 10--SCREEN Mean Profile (First Grade)

ITPA: None

WISC: None

VMI: No

PIAT: (M-%tile, 95% Conf. Int.)
Math (34th, 24th to 47th)

Phonetics: L & S Vowels
Cons. Blends
Total

Age: 88.14 Months
N = 14, 3.60% of Sample

Females: N = 5
Males: N = 9

Regular Class: N = 9
Open Space: N = 5

Significant Below Average Performance (LSDMOD, $p < .05$):

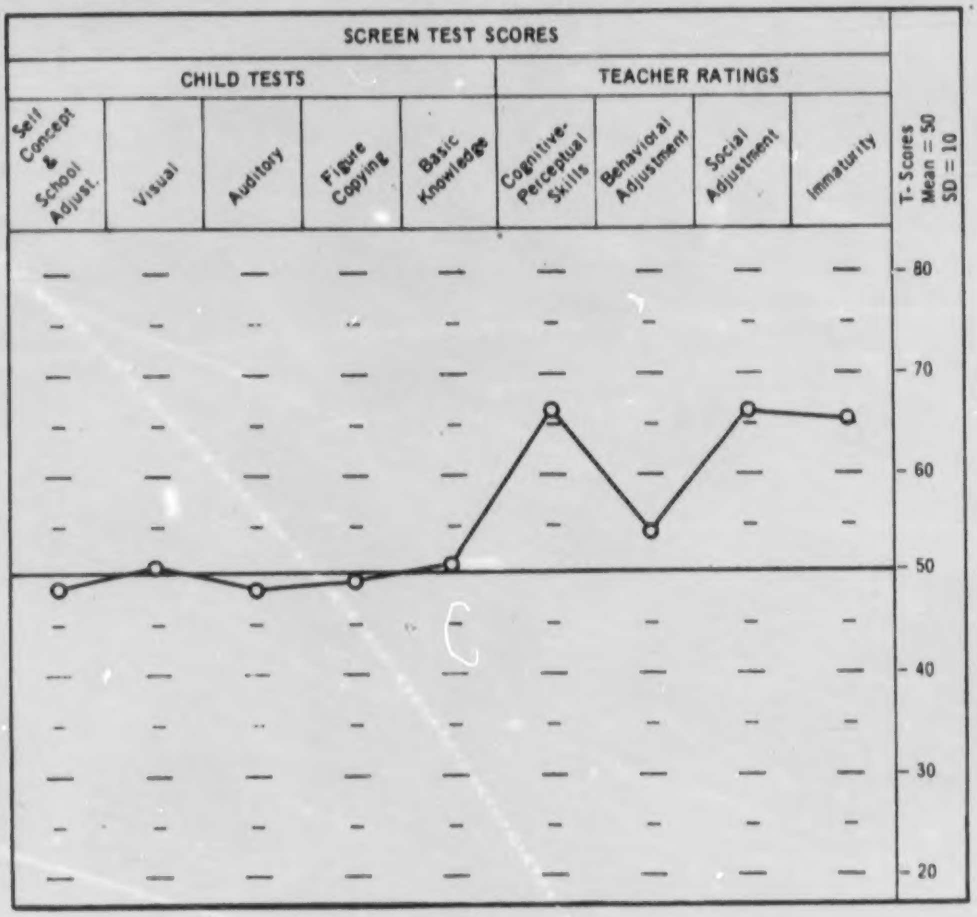

Figure 22. Cluster 11--SCREEN Mean Profile (First Grade)

ITPA:	(M-S.S., 95% Conf. Int.)
Gra. Cl.	(31, 26 to 37)
Sd. Bl.	(37, 33 to 42)

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(36th, 23rd to 49th)
Read. Com.	(36th, 24th to 49th)
Total	(29th, 19th to 39th)

WISC: None

Phonetics: Total

VMI: No

Age: 93.50 Months
N = 2, .50% of Sample

Females: N = 1
Males: N = 1

Regular Class: N = 2
Open Space: N = 0

Significant Above** and Below* Average Performance:

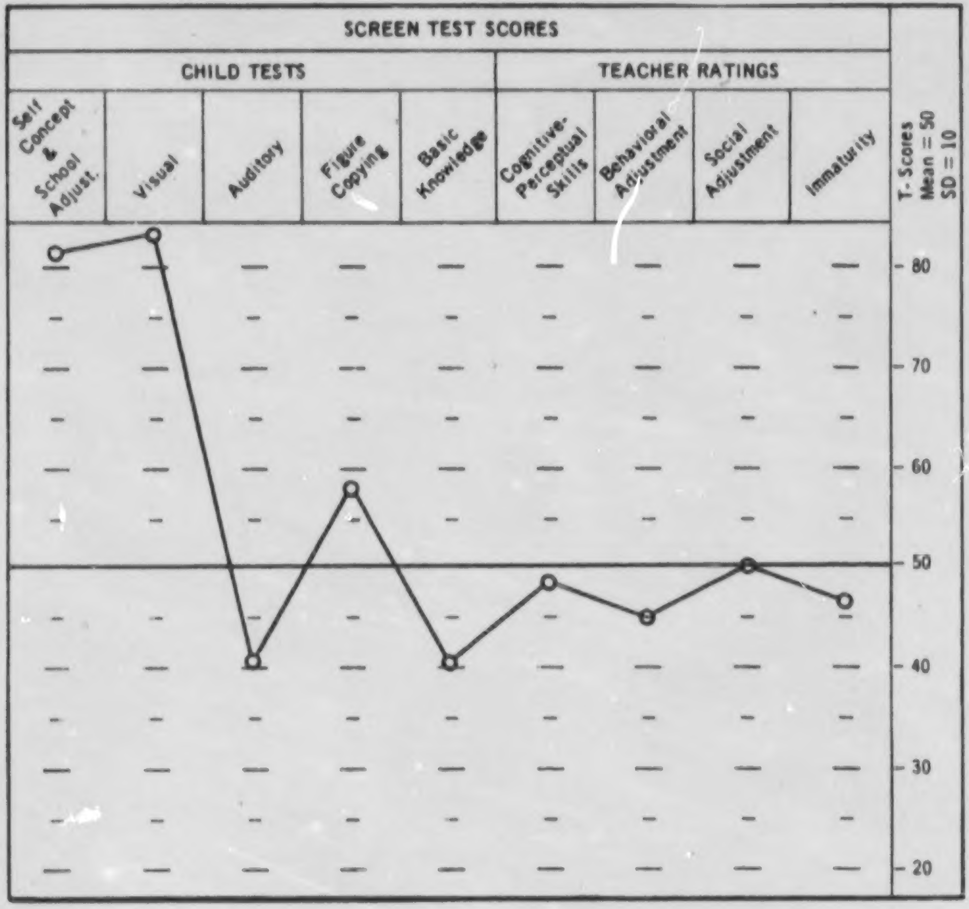

Figure 23. Outlying Cluster 14--SCREEN Mean Profile (First Grade)

ITPA:	(M-S.S., 95% Conf. Int.)
Aud. As.	(35, 26 to 43)*,**
Aud. S. M.	(35, 28 to 43)*,**
Aud. Rec.	(42, 41 to 43)**
Vis. Rec.	(43, 42 to 44)**
Vis. As.	(41, 37 to 44)**
Vis. Cl.	(39, 34 to 45)**
Ver. Ex.	(32, 30 to 35)*
Gra. Cl.	(34, 26 to 43)*,**
PLQ	(106, [illegible]9 to 123)*,**

WISC:	(M-%tile, 95% Conf. Int.)
Comp.	(9th, 2nd to 37th)*
Sim.	(24th, 9th to 63rd)*,**
Vocab.	(16th, 16th to 24th)*
Dig. Span	(37th, 24th to 50th)*
Verbal IQ	(87-IQ, 76-IQ to 97-IQ)*

PIAT:	(M-%tile, 95% Conf. Int.)
Read. Rec.	(52nd, 27th to 77th)*,**
Gen. Inf.	(57th, 36th to 79th)*,**
Total	(46th, 29th to 60th)*

Phonetics: None

VMI: Yes
(1½ years below age)

Age:	88.42 Months	Females:	N = 0*	Regular Class:	N = 11*
N = 12, 3.10% of Sample		Males:	N = 12	Open Space:	N = 1

Significant Above** and Below* Average Performance (LSDMOD, p < .05):

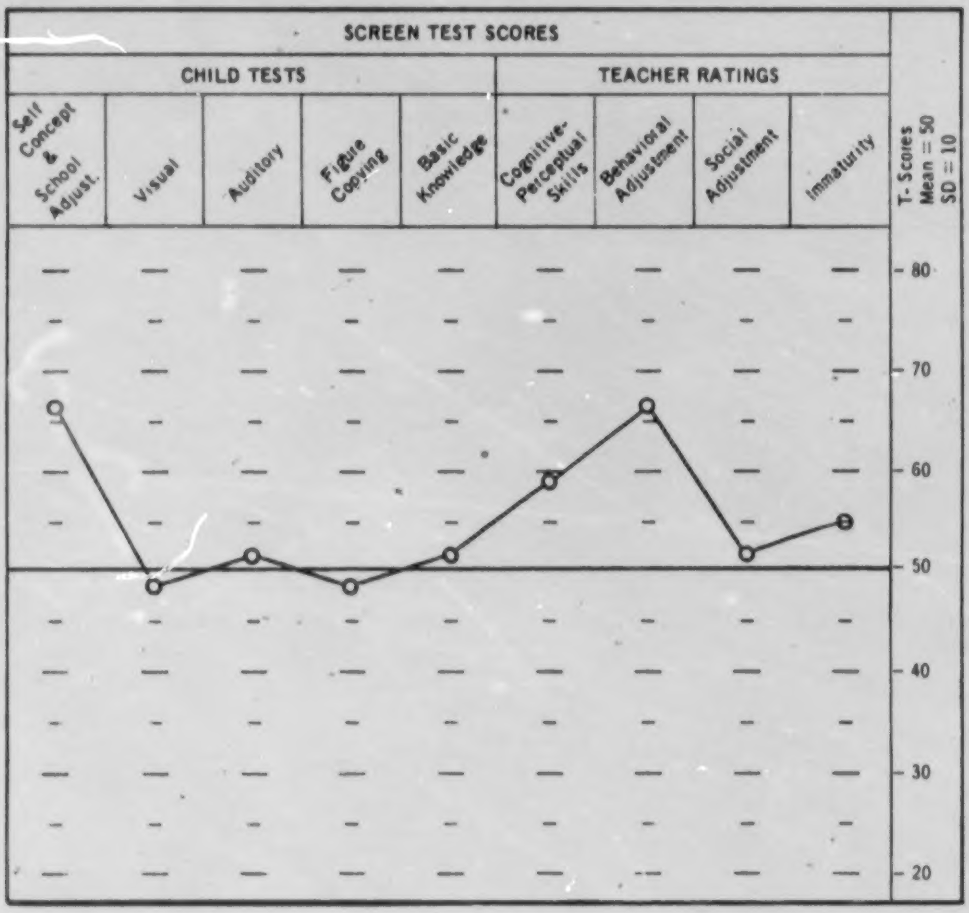

Figure 24. Cluster 8--SCREEN Mean Profile (First Grade)

ITPA: None

WISC: None

VMI: No

PIAT: (M-%tile, 95% Conf. Int.)
Math (40th, 24th to 64th)*,**

Phonetics: None

Age:	85.14 Months	Females:	N = 4	Regular Class:	N = 7*
N = 7, 1.80% of Sample		Males:	N = 3	Open Space:	N = 0

Significant Above Average Performance (LSDMOD, $p < .05$):

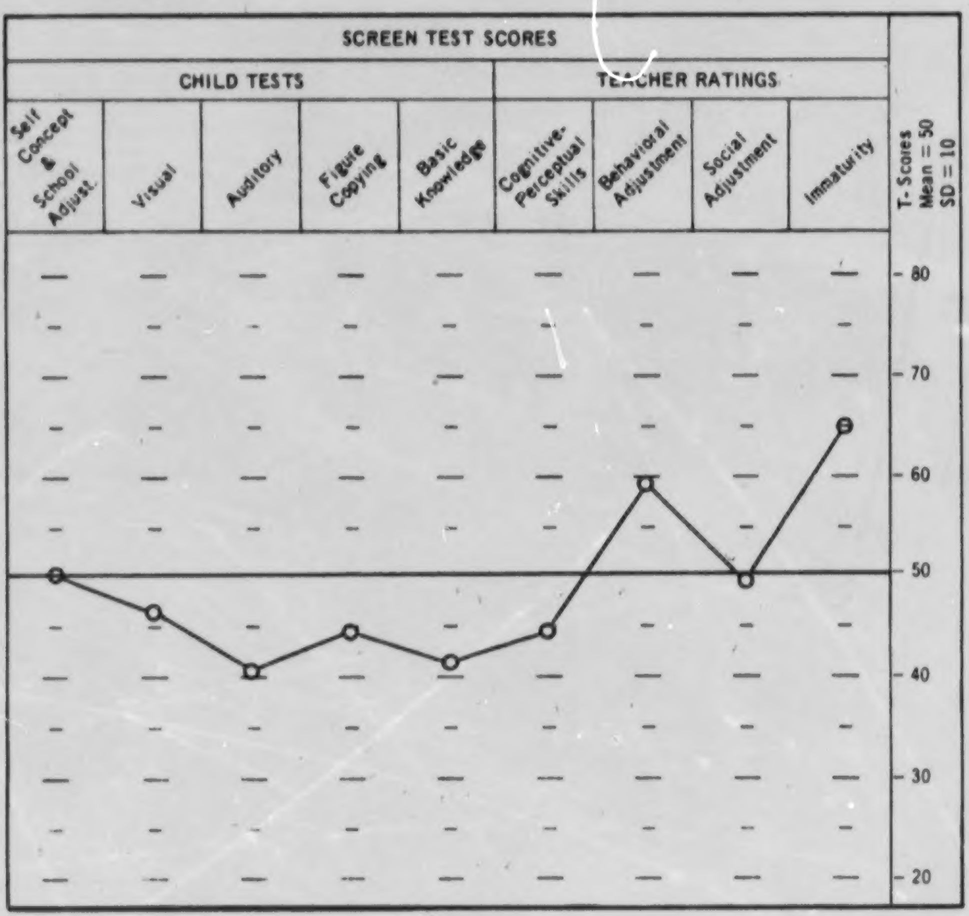

Figure 25. Cluster 2--SCREEN Mean Profile (First Grade)

ITPA:	(M-S.S., 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Grm. Cl.	(43, 36 to 49)	Read. Com.	(81st, 60th to 92nd)
Sd. Bl.	(49, 44 to 54)	Total	(71st, 46th to 90th)
PIQ	(113, 104 to 122)		

Phonetics: Cons. Blends
Total

WISC: None

VMI: No

Age: 86.00 Months
N = 25, 6.40% of Sample

Females: N = 4*
Males: N = 21

Regular Class: N = 21
Open Space: N = 4

Significant Above Average Performance (LSDMOD, $p < .05$):

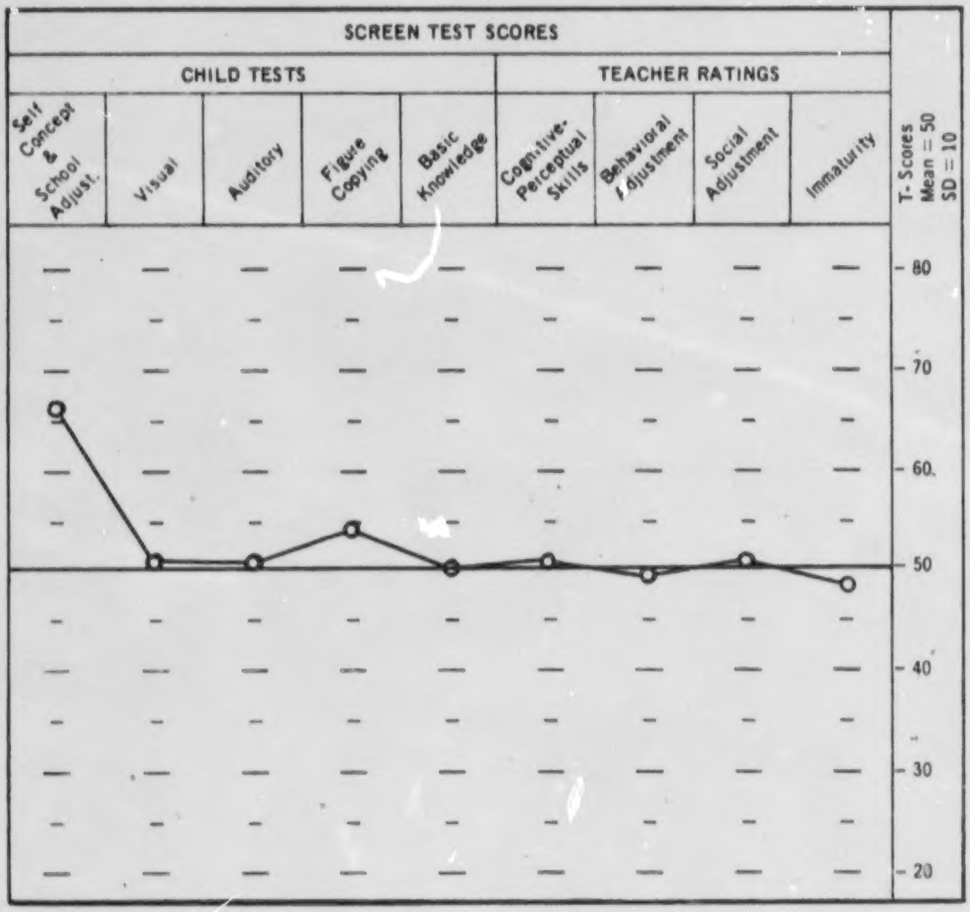

Figure 26. Cluster 9--SCREEN Mean Profile (First Grade)

ITPA: None

WISC: None

VMI: No

PIAT: (M-%tile, 95% Conf. Int.)
Read. Com. (71st, 60th to 77th)

Phonetics: Cons. Blends

Age: 87.46 Months	Females: N = 36	Regular Class: N = 75
N = 101, 26.00% of Sample	Males: N = 65	Open Space: N = 26

Significant Above Average Performance (LSDMOD, $p < .05$):

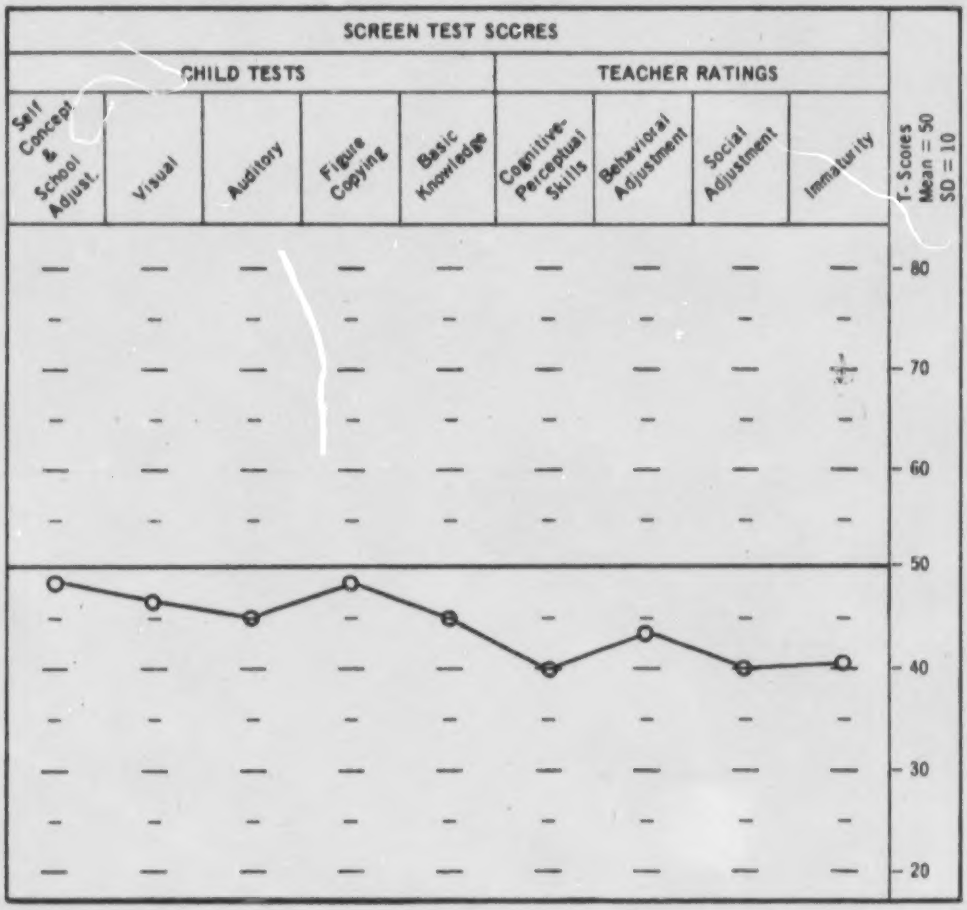

Figure 27. Cluster 13--SCREEN Mean Profile (First Grade)

ITPA:	(M-S.S., 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Vis. As.	(38, 37 to 40)	Math	(66th, 60th to 68th)
PLQ	(109, 106 to 111)	Read. Com.	(68th, 67th to 74th)
		Total	(66th, 64th to 71st)

WISC: None

Phonetics: Cons. Blends
Total

VMI: No

Age:	85.81 Months	Females:	N = 5*	Regular Class:	N = 18
N = 21, 5.40% of Sample		Males:	N = 16	Open Space:	N = 3

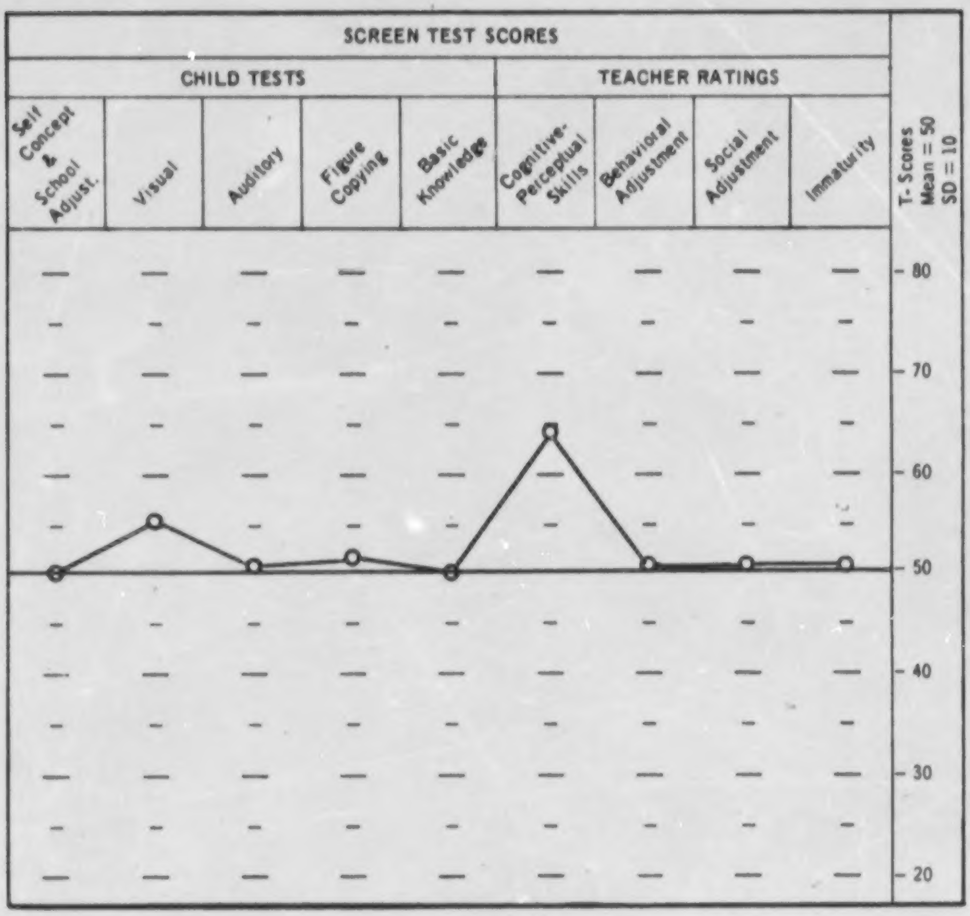

Figure 28. Cluster 1--SCREEN Mean Profile (First Grade)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

Age:	86.63 Months	Females:	N = 3*	Regular Class:	N = 17
N = 24, 6.20% of Sample		Males:	N = 21	Open Space:	N = 7

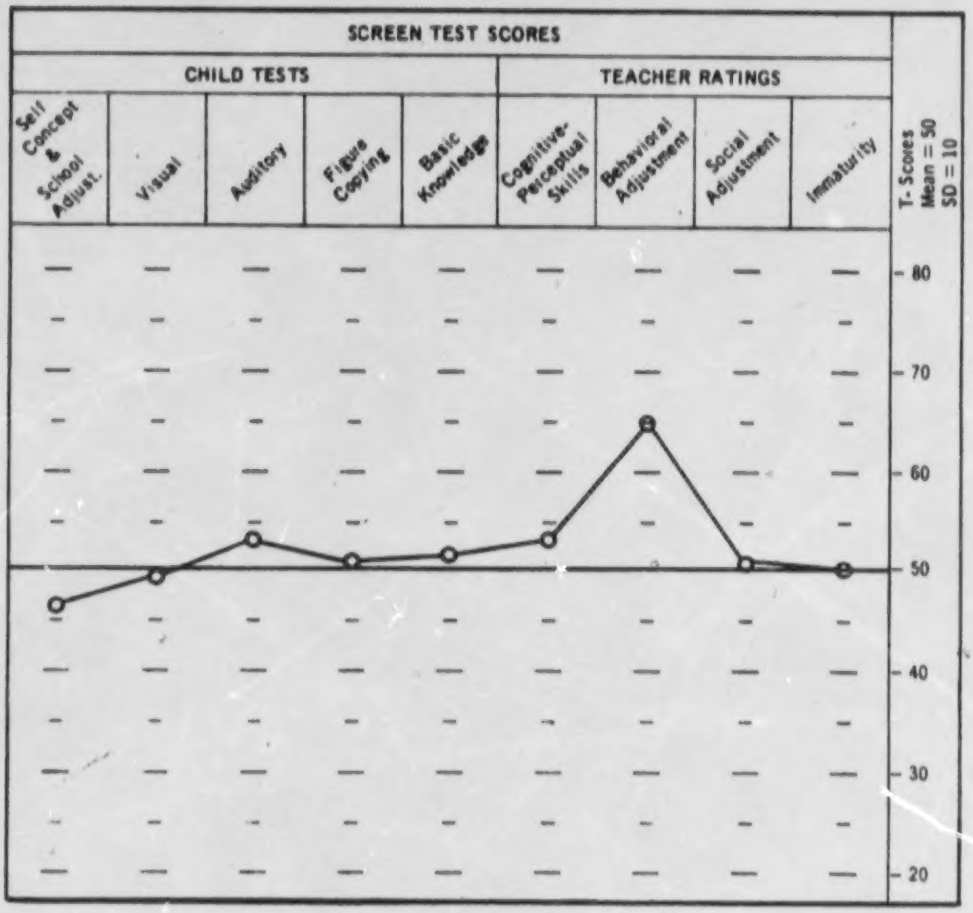

Figure 29. Cluster 5--SCREEN Mean Profile (First Grade)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

Age:	86.33 Months	Females:	N = 2*	Regular Class:	N = 8
N = 9, 2.30% of Sample		Males:	N = 7	Open Space:	N = 1

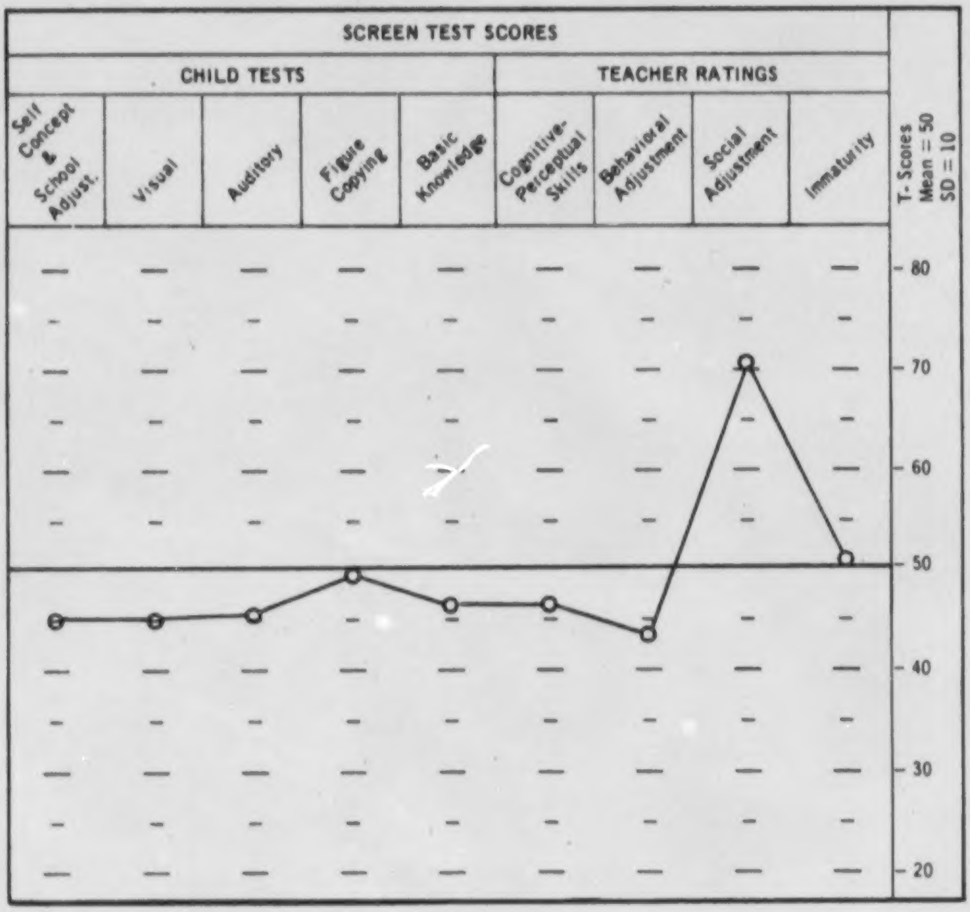

Figure 30. Cluster 3--SCREEN Mean Profile (First Grade)

ITPA: None	PIAT: None
WISC: None	Phonetics: None
VMI: No	

Age: 86.58 Months
N = 31, 8.00% of Sample

Females: N = 17*
Males: N = 14

Regular Class: N = 23
Open Space: N = 8

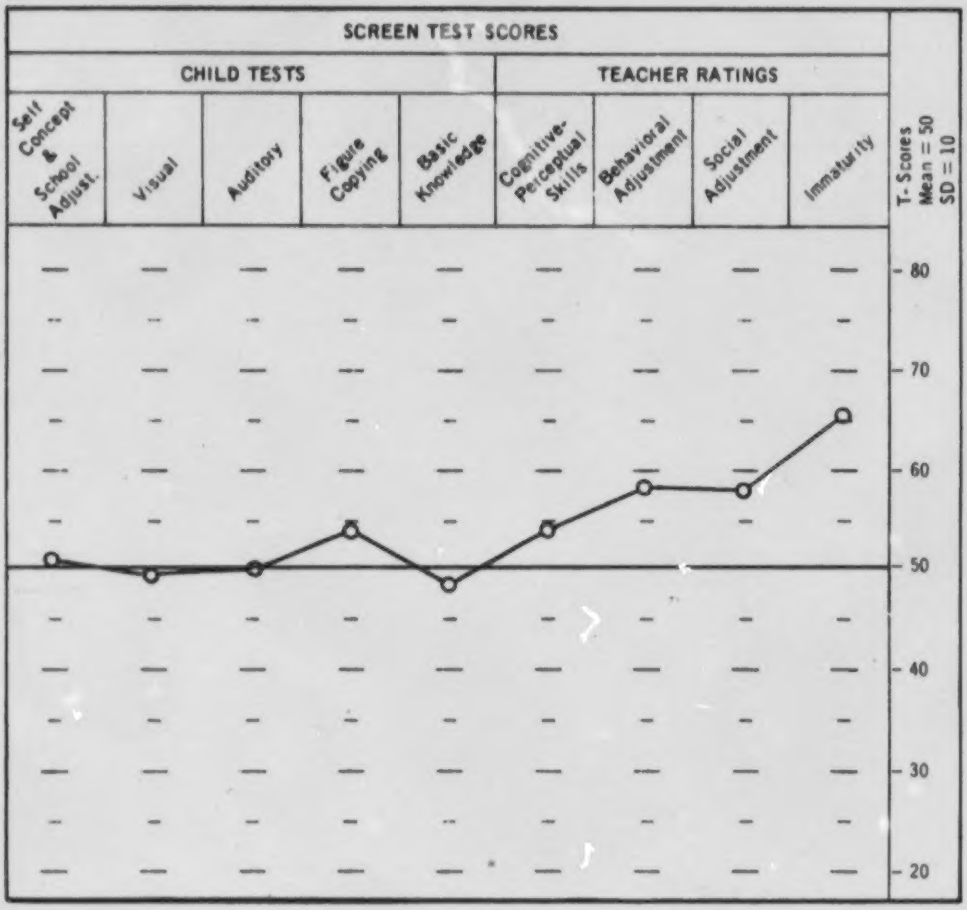

Figure 31. Cluster 12--SCREEN Mean Profile (First Grade)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

Age:	86.93 Months	Females:	N = 39	Regular Class:	N = 66
N = 80, 20.60% of Sample		Males:	N = 41	Open Space:	N = 14

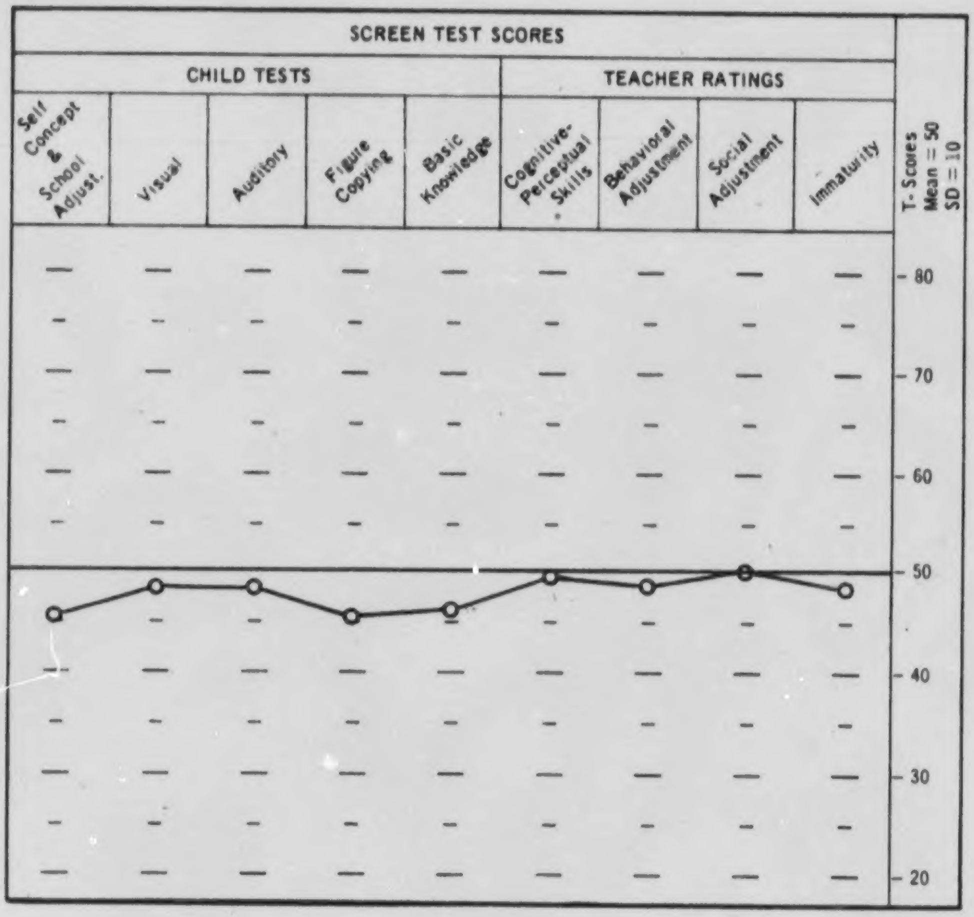

Figure 32. Cluster 4--SCREEN Mean Profile (First Grade)

ITPA: None

PIAT: None

WISC: None

Phonetics: None

VMI: No

APPENDIX F

ITPA MEAN PROFILES BY CLUSTER DESIGNATION FOR THE KINDERGARTEN SAMPLE

Age: 75.36 Months
N = 11, .80% of Sample

Females: N = 3
Males: N = 8

Regular Class: N = 7
Open Space: N = 4

Significant Below Average Performance (LSDMOD, $p < .05$):

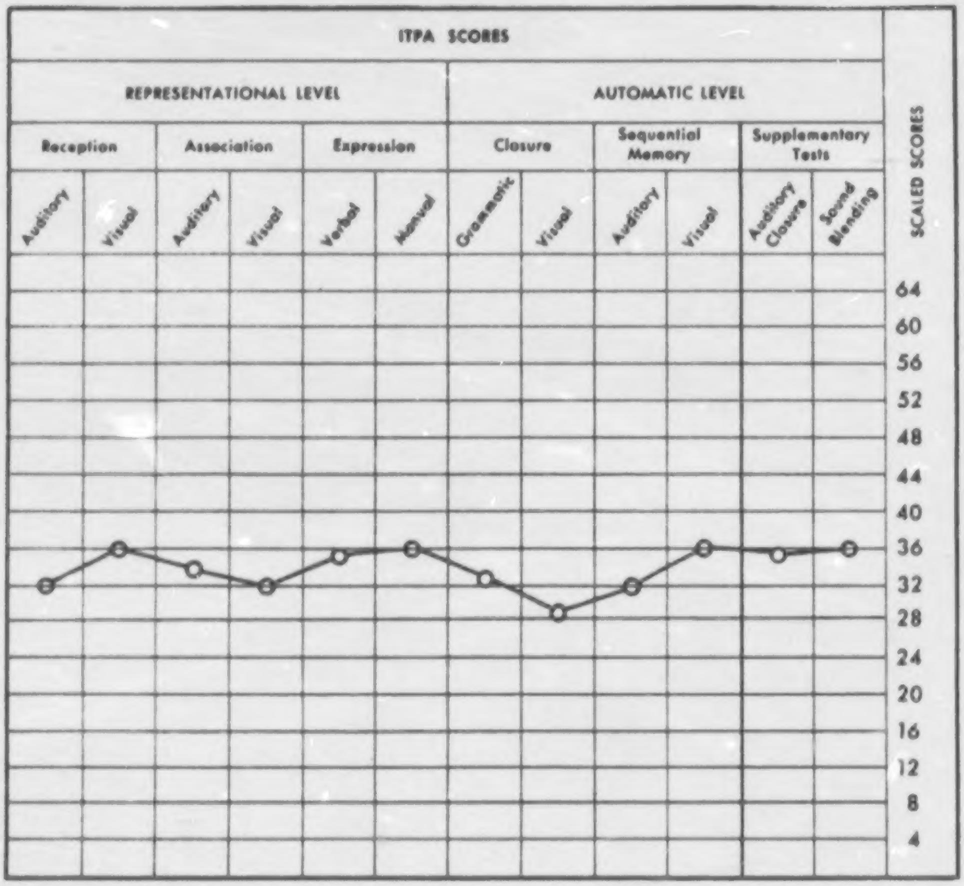

Figure 33. Cluster 3--ITPA Mean Profile (Kindergarten)

WISC: None

VMI: No

PIAT: (M-%tile, 95% Conf. Int.)
Read. Rec. (36th, 22nd to 49th)
Total (29th, 19th to 41st)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Total

Age: 75.67 Months	Females: N = 4	Regular Class: N = 12
N = 15, 4.00% of Sample	Males: N = 11	Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

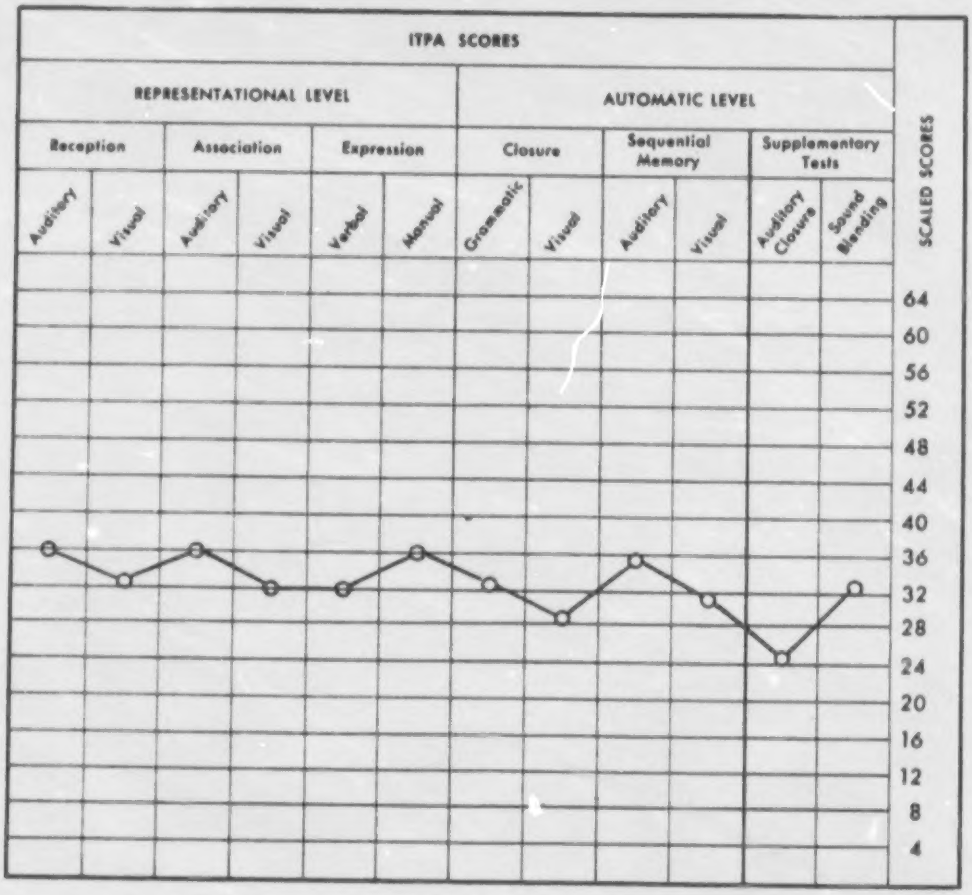

Figure 34. Cluster 5--ITPA Mean Profile (Kindergarten)

WISC:	(M-%tile, 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Sim.	(16th, 9th to 37th)	Read. Rec.	(36th, 27th to 49th)
Verbal IQ	(87-IQ, 80-IQ to 95-IQ)	Spelling	(34th, 27th to 39th)
VMI:	Yes	Gen. Inf.	(36th, 25th to 49th)
		Total	(27th, 21st to 36th)
		Phonetics:	Init. Cons. L & S Vowels Final Cons. Cons. Blends Total

Age: 76.67 Months Females: N = 8 Regular Class: N = 7
N = 12, 3.20% of Sample Males: N = 4 Open Space: N = 5

Significant Below Average Performance (LSDMOD, $p < .05$):

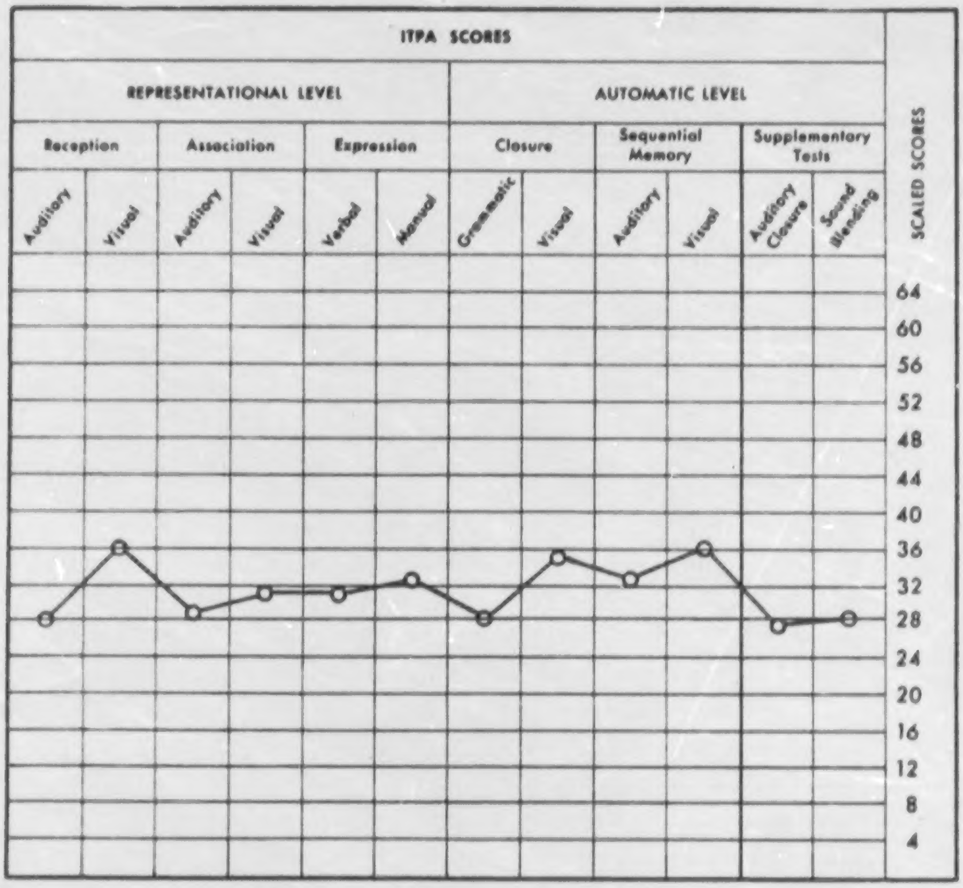

Figure 35. Cluster 15--ITPA Mean Profile (Kindergarten)

WISC:	(M-%tile, 95% Conf. Int.)
Comp.	(9th, 5th to 24th)
Sim.	(16th, 9th to 24th)
Verbal IQ	(81-IQ, 77-IQ to 86-IQ)

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(23rd, 11th to 36th)
Spelling	(29th, 17th to 44th)
Gen. Inf.	(21st, 10th to 34th)
Total	(21st, 11th to 37th)

VMI: No

Phonetics: Init. Cons.
Total

Age: 76.35 Months
N = 20, 5.30% of Sample

Females: N = 8
Males: N = 12

Regular Class: N = 12
Open Space: N = 8

Significant Below Average Performance (LSDMOD, $p < .05$):

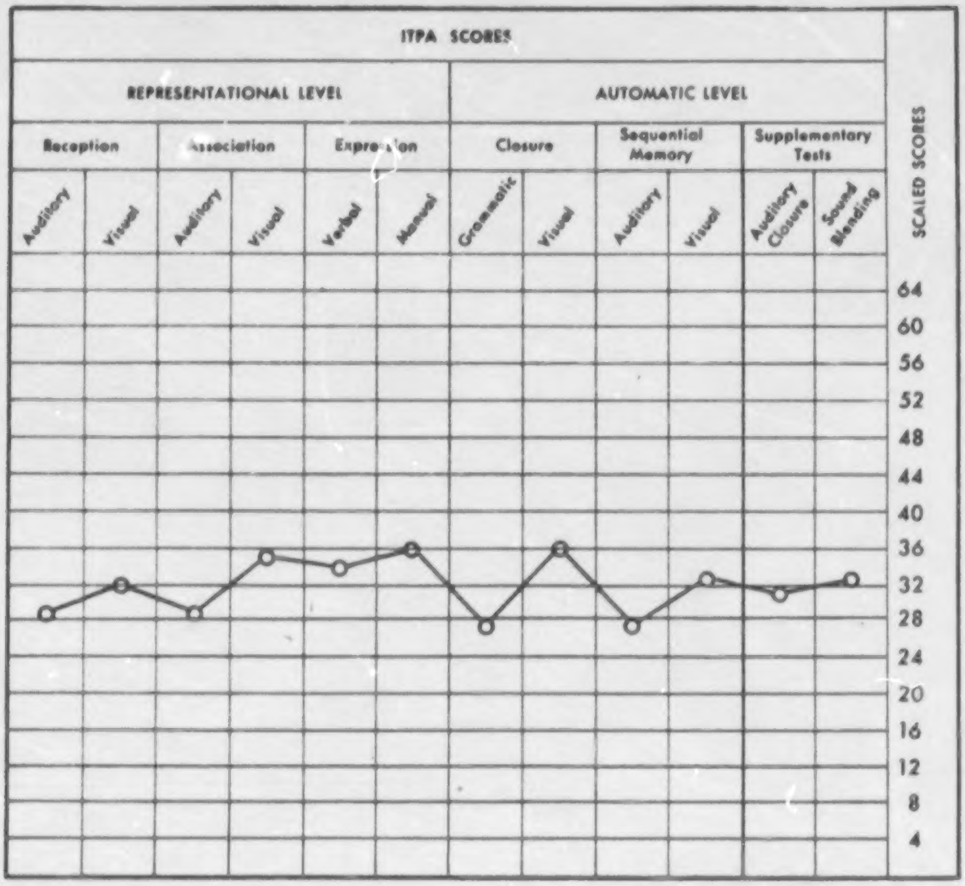

Figure 36. Cluster 16--ITPA Mean Profile (Kindergarten)

WISC:	(M-%tile, 95% Conf. Int.)
Vocab.	(24th, 16th to 24th)
Dig. Span	(16th, 9th to 24th)
Verbal IQ	(86-IQ, 81-IQ to 90-IQ)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(23rd, 16th to 34th)
Read. Rec.	(31st, 21st to 41st)
Spelling	(32nd, 25th to 41st)
Gen. Inf.	(31st, 21st to 44th)
Total	(21st, 14th to 31st)

Phonetics: L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 74.60 Months
N = 25, 6.60% of Sample

Females: N = 7
Males: N = 18

Regular Class: N = 16
Open Space: N = 9

Significant Below Average Performance (LSDMOD, $p < .05$):

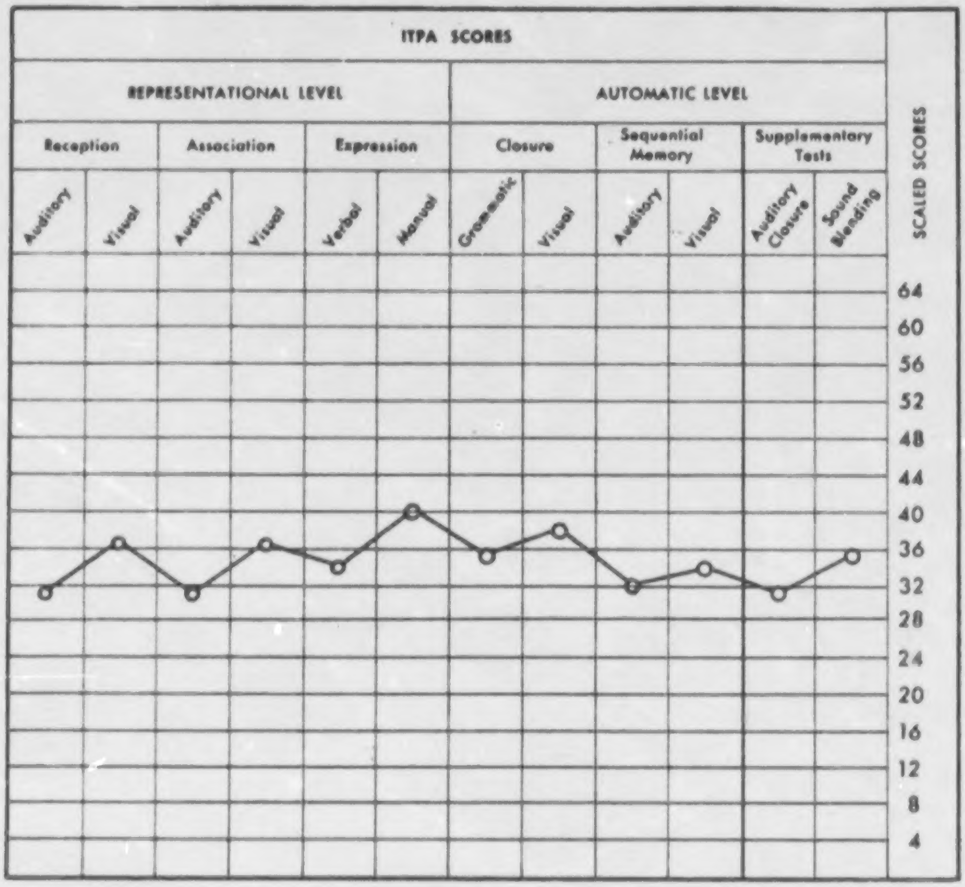

Figure 37. Cluster 17--ITPA Mean Profile (Kindergarten)

WISC:	(M-%tile, 95% Conf. Int.)
Vocab.	(24th, 16th to 37th)
Dig. Span	(16th, 9th to 24th)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(31st, 25th to 39th)
Read. Rec.	(31st, 21st to 41st)
Spelling	(36th, 29th to 47th)
Gen. Inf.	(29th, 19th to 41st)
Total	(23rd, 19th to 29th)

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 83 Months	Females: N = 0	Regular Class: N = 1
N = 1, .27% of Sample	Males: N = 1	Open Space: N = 0

Significant Below Average Performance:

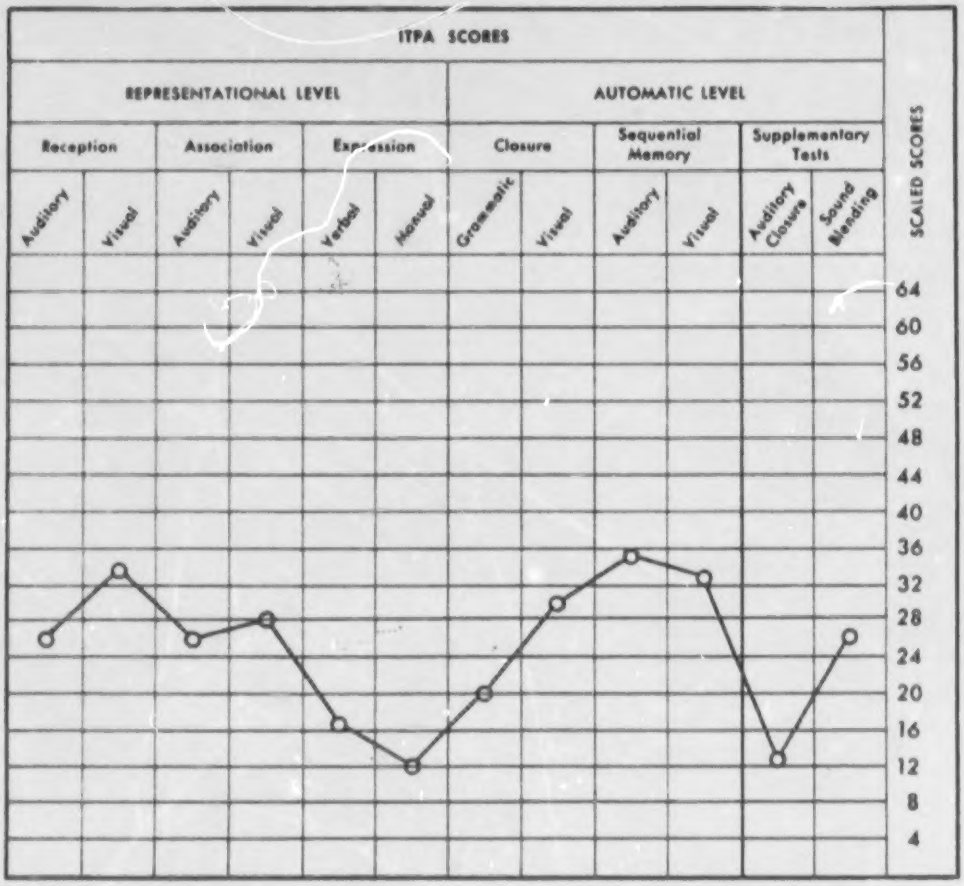

Figure 38. Outlying Cluster 6--ITPA Mean Profile (Kindergarten)

WISC:	(%tile)	PIAT:	(%tile)	Phonetics:	
Comp.	(16th)	Math	(10th)		Init. Cons.
Sim.	(5th)	Read. Rec.	(14th)		L & S Vowels
Vocab.	(4th)	Spelling	(11th)		Final Cons.
Dig. Span	(9th)	Gen. Inf.	(4th)		Cons. Blends
Verbal IQ	(72)	Total	(5th)		Total

VMI: Yes

Age: 73.33 Months		Females:	N = 0	Regular Class:	N = 1
N = 3, .80% of Sample		Males:	N = 3	Open Space:	N = 2

Significant Above Average Performance:

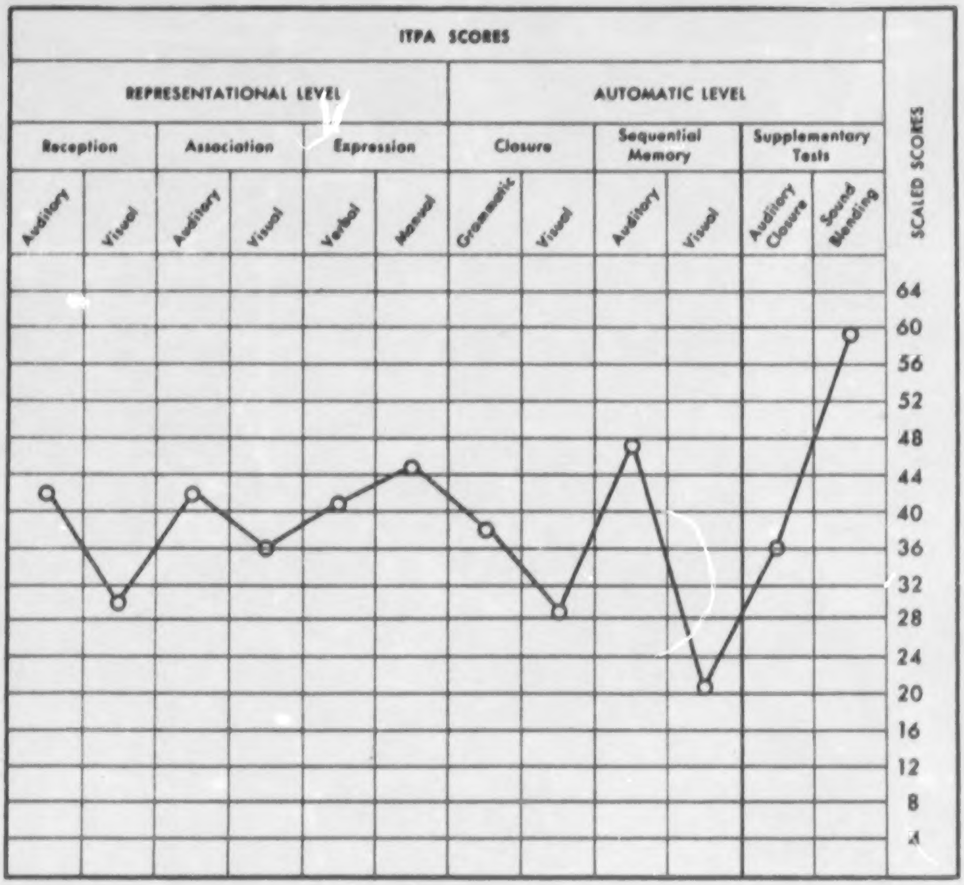

Figure 39. Outlying Cluster 7--ITPA Mean Profile (Kindergarten)

WISC: (M-%tile, 95% Conf. Int.)
Dig. Span (84th, 63rd to 98th)
Verbal IQ (110-IQ, 106-IQ to 114-IQ)

PIAT: None

Phonetics: None

VMI: No

Age: 74.75 Months	Females: N = 1	Regular Class: N = 4
N = 4, 1.06% of Sample	Males: N = 3	Open Space: N = 0

Significant Above** and Below* Average Performance:

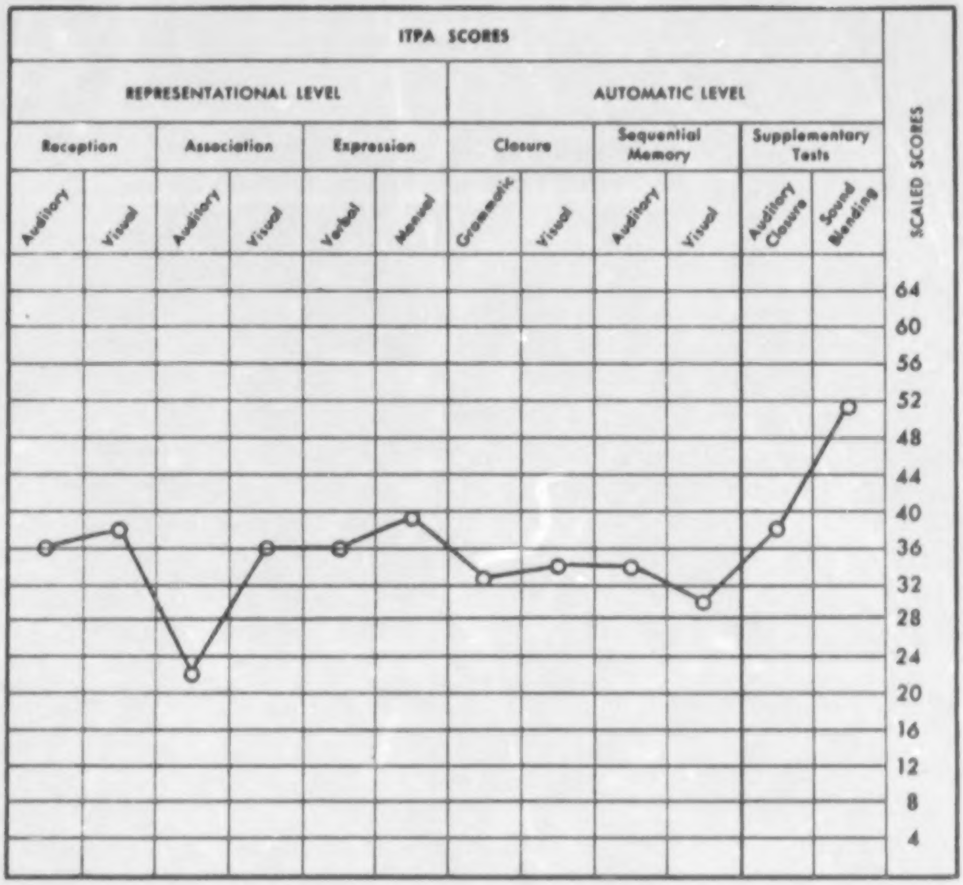

Figure 40. Outlying Cluster 9--ITPA Mean Profile (Kindergarten)

WISC*:	(M-%tile, 95% Conf. Int.)	PIAT**:	(M-%tile, 95% Conf. Int.)
Sim.	(24th, 5th to 91st)	Read. Rec.	(66th, 46th to 83rd)
Vocab.	(24th, 9th to 24th)	Spelling	(66th, 48th to 84th)
Dig. Span	(24th, 2nd to 50th)		
Verbal IQ	(84-IQ, 67-IQ to 94-IQ)	Phonetics:	None

VMI: No

Age: 74.50 Months
N = 24, 6.40% of Sample

Females: N = 10
Males: N = 14

Regular Class: N = 18
Open Space: N = 6

Significant Above Average Performance (LSDMOD, $p < .05$):

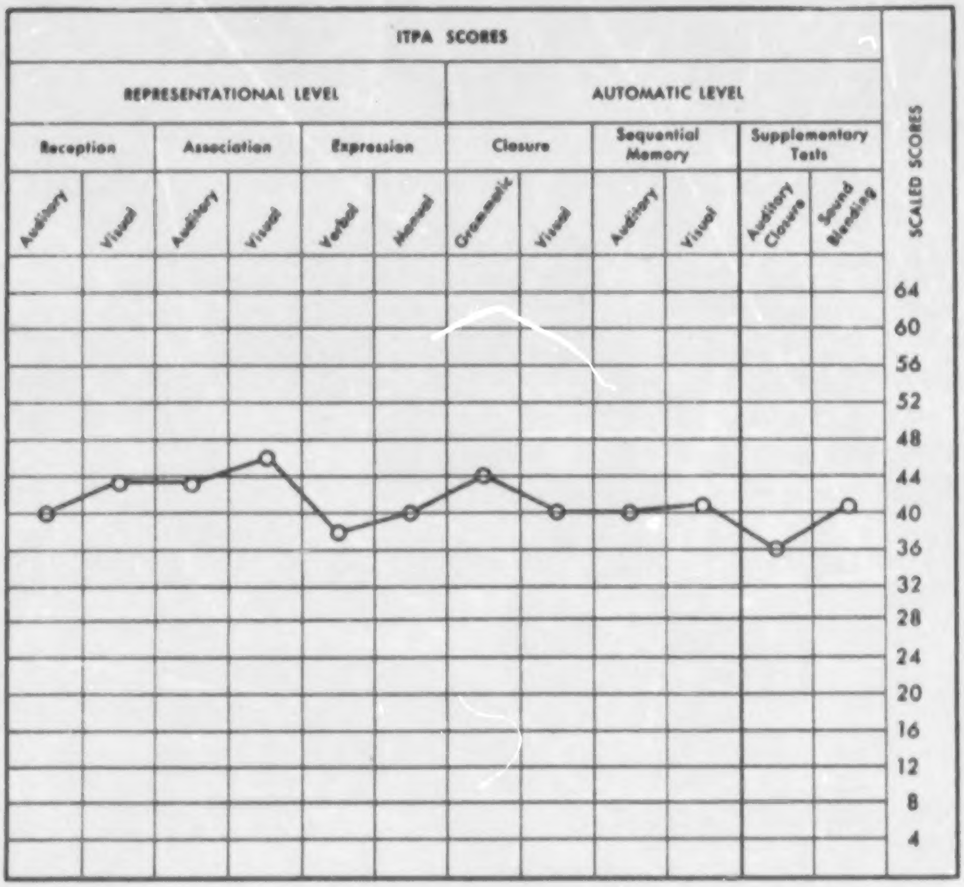

Figure 41. Cluster 12--ITPA Mean Profile (Kindergarten)

WISC: None

VMI: Yes

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(66th, 56th to 79th)
Total	(66th, 55th to 73rd)

Phonetics: Init. Cons.
Total

Age: 73.50 Months
N = 64, 17.00% of Sample

Females: N = 20
Males: N = 44

Regular Class: N = 50
Open Space: N = 14

Significant Above Average Performance (LSDMOD, $p < .05$):

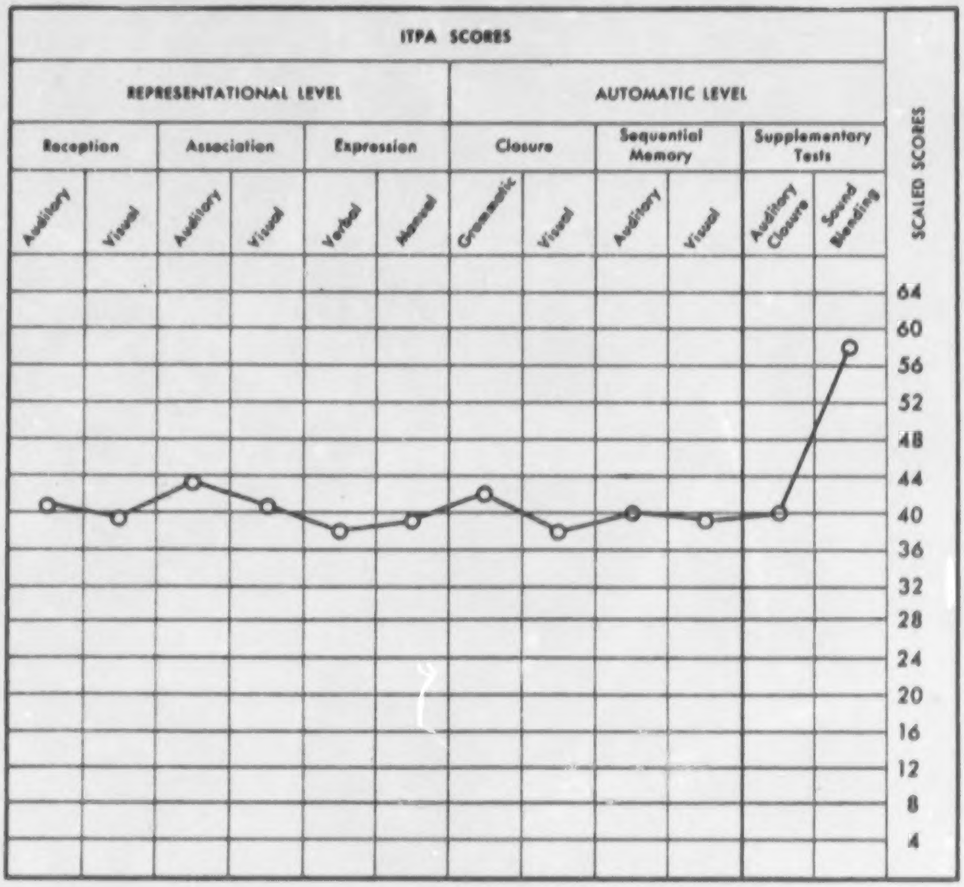

Figure 42. Cluster 18--ITPA Mean Profile (Kindergarten)

WISC:	(M-%tile, 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Sim.	(84th, 75th to 91st)	Math	(70th, 66th to 77th)
Vocab.	(63rd, 50th to 75th)	Read. Rec.	(79th, 73rd to 84th)
Dig. Span	(75th, 63rd to 75th)	Spelling	(74th, 68th to 79th)
Verbal IQ	(111-IQ, 108-IQ to 115-IQ)	Gen. Inf.	(71st, 65th to 75th)
		Total	(72nd, 69th to 79th)

VMI: No

Phonetics: Init. Cons.
L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 73.70 Months
N = 30, 8.00% of Sample

Females: N = 11
Males: N = 19

Regular Class: N = 22
Open Space: N = 8

Significant Above Average Performance (LSDMOD, p <.05):

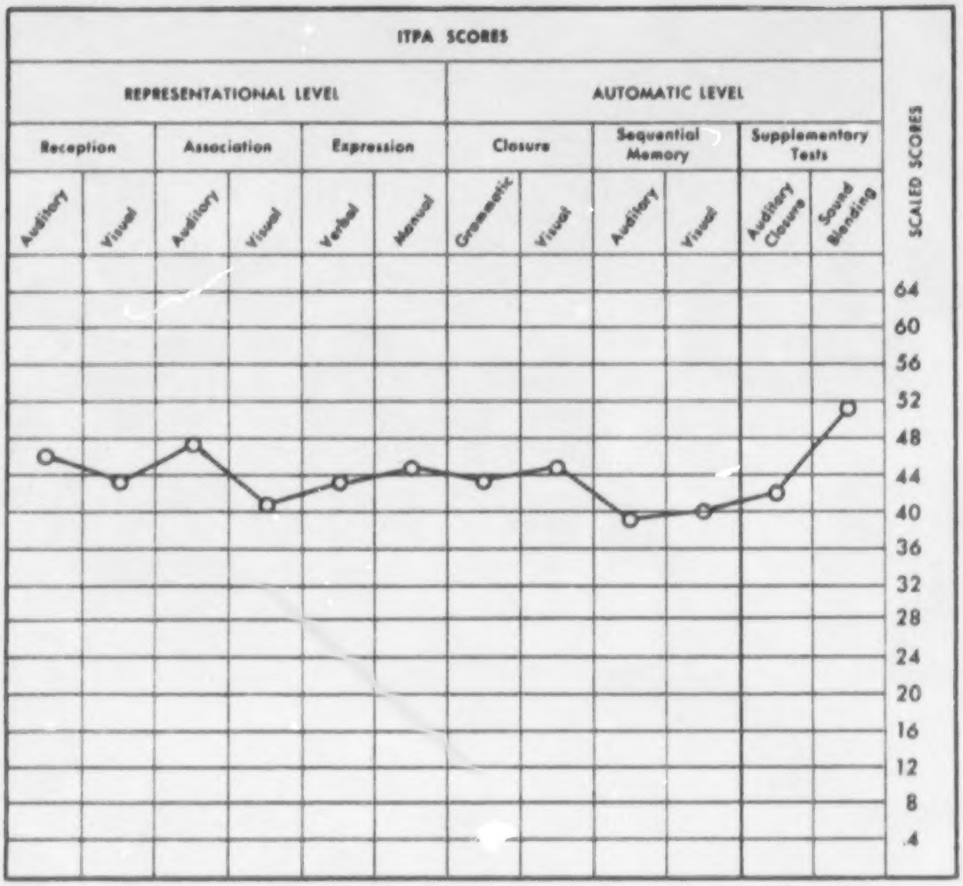

Figure 43. Cluster 19--ITPA Mean Profile (Kindergarten)

WISC:	(M-%tile, 95% Conf. Int.)
Comp.	(75th, 63rd to 84th)
Sim.	(84th, 75th to 95th)
Vocab.	(75th, 63rd to 84th)
Dig. Span	(75th, 63rd to 84th)
Verbal IQ	(115-IQ, 111-IQ to 120-IQ)

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(68th, 63rd to 75th)
Read. Rec.	(75th, 70th to 84th)
Spelling	(74th, 68th to 80th)
Gen. Inf.	(83rd, 77th to 86th)
Total	(77th, 71st to 83rd)

Phonetics: Init. Cons.
Final Cons.
Cons. Blends
Total

VMI: No

Age: 76.78 Months
N = 9, 2.40% of Sample

Females: N = 2
Males: N = 7

Regular Class: N = 7
Open Space: N = 2

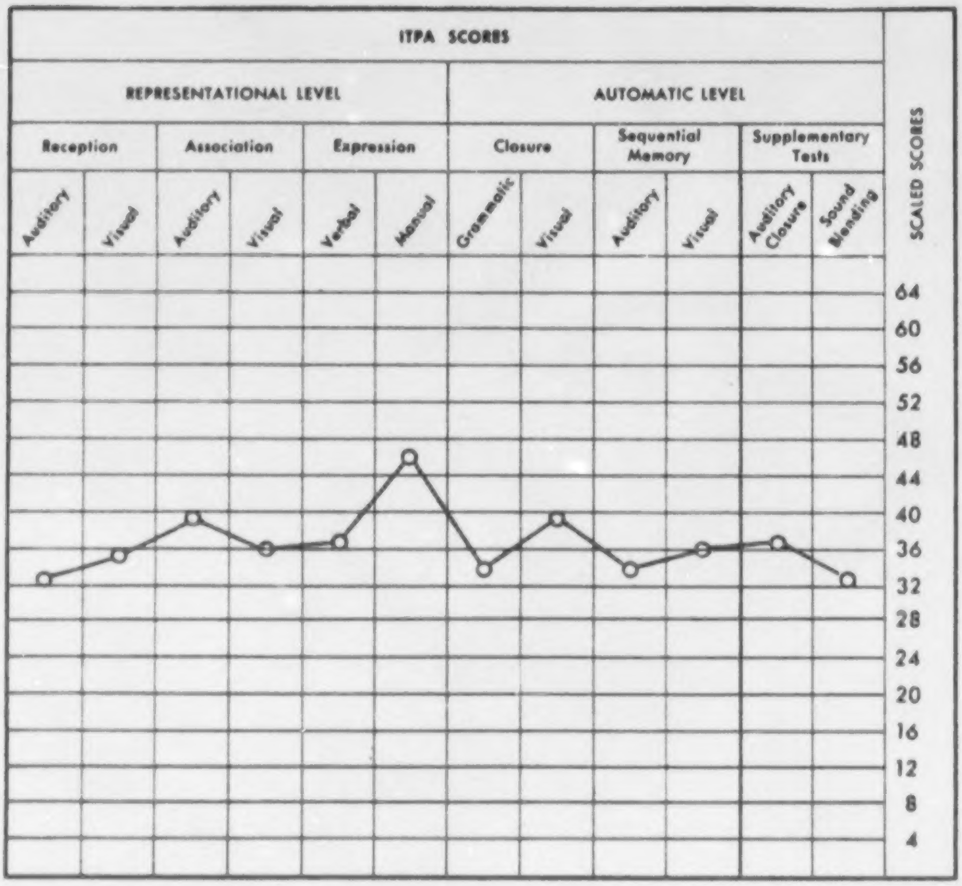

Figure 44. Cluster 1--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: No

Phonetics: None

Age: 75.16 Months
N = 31, 8.20% of Sample

Females: N = 12
Males: N = 19

Regular Class: N = 23
Open Space: N = 8

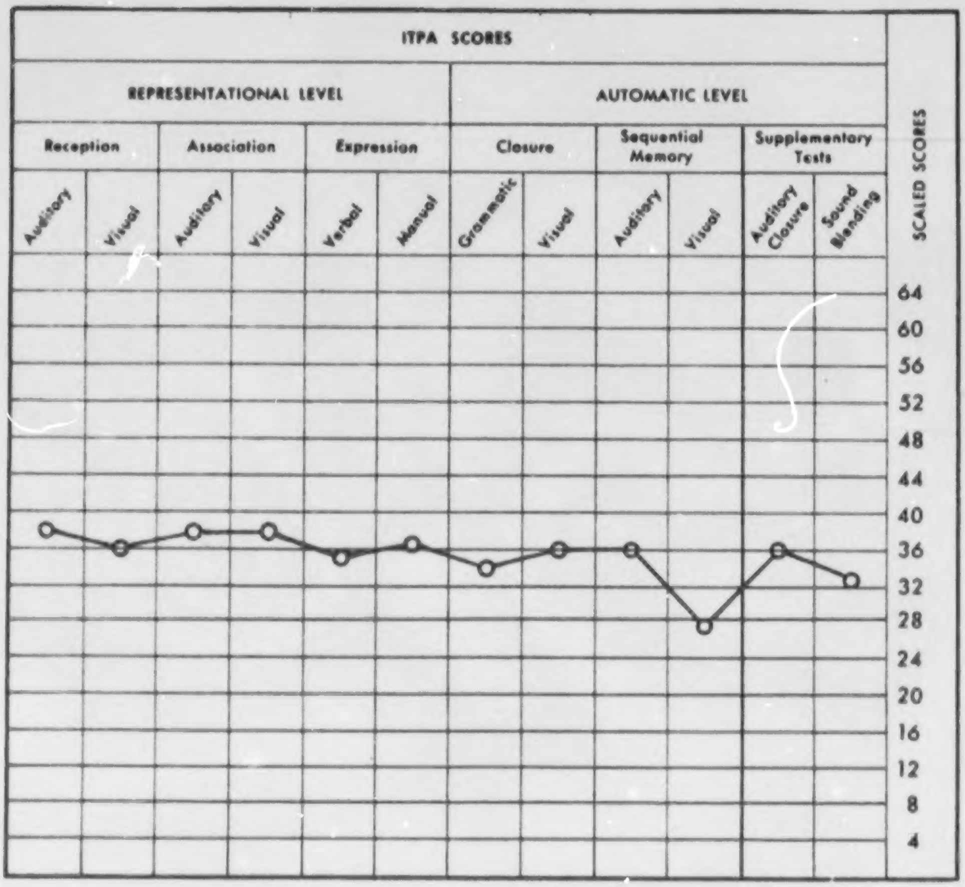

Figure 45. Cluster 2--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: No

Phonetics: None

Age: 74.28 Months
N = 25, 6.60% of Sample

Females: N = 11
Males: N = 14

Regular Class: N = 19
Open Space: N = 6

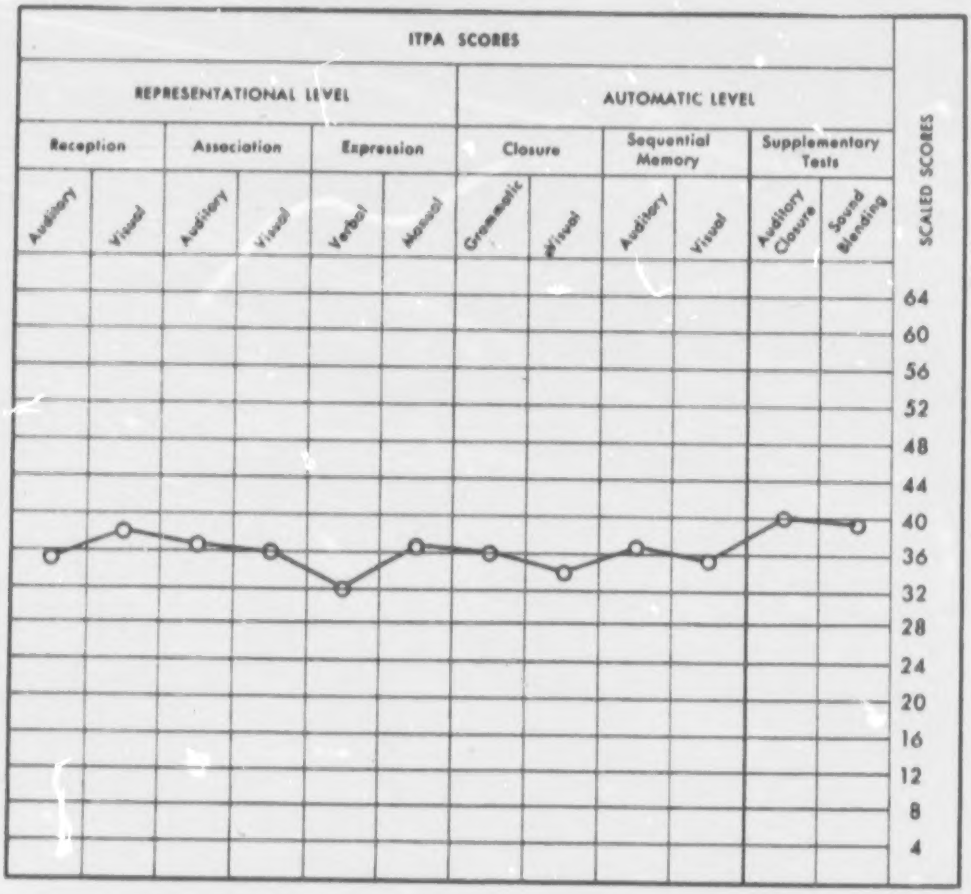

Figure 46. Cluster 4--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: No

Phonetics: None

Age: 75.16 Months Females: N = 8 Regular Class: N = 11
N = 19, 5.00% of Sample Males: N = 11 Open Space: N = 8

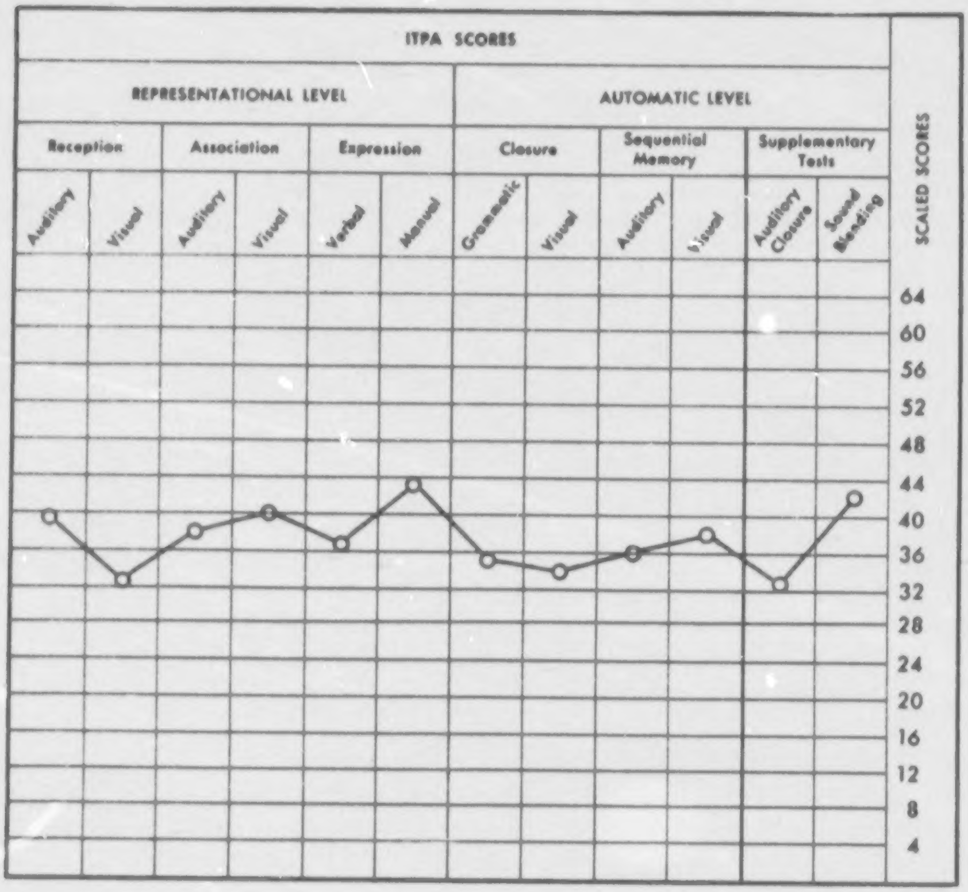

Figure 47. Cluster 8--ITPA Mean Profile (Kindergarten)

WISC: None PIAT: None

VMI: No Phonetics: None

Age: 75.21 Months
N = 19, 5.00% of Sample

Females: N = 9
Males: N = 10

Regular Class: N = 14
Open Space: N = 5

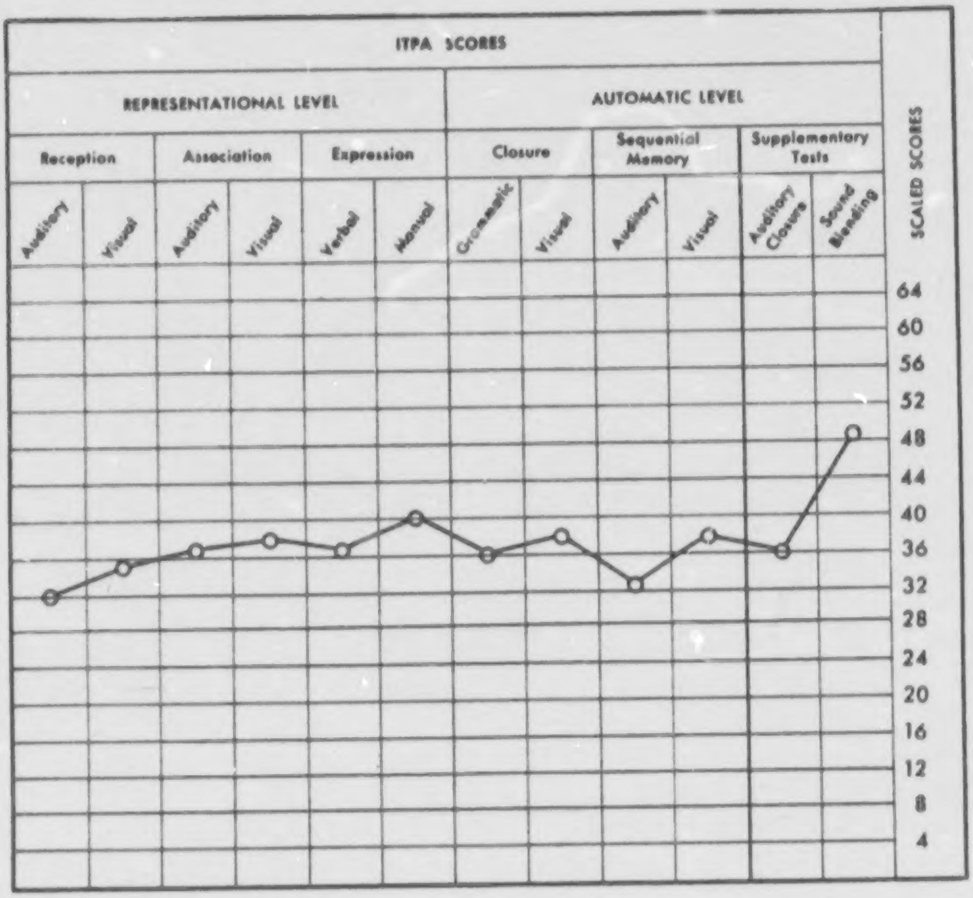

Figure 48. Cluster 10--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: No

Phonetics: None

Age: 74.50 Months
N = 16, 4.30% of Sample

Females: N = 7
Males: N = 9

Regular Class: N = 13
Open Space: N = 3

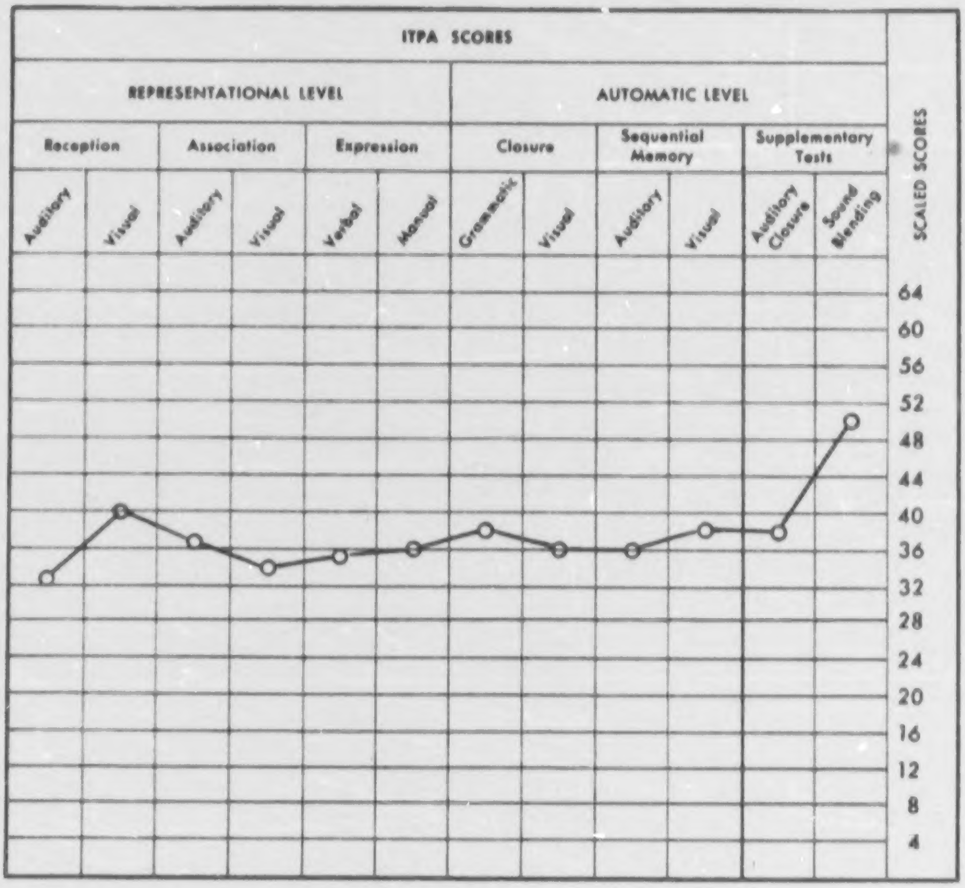

Figure 49. Cluster 11--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: No

Phonetics: None

Age: 72.75 Months
N = 12, 3.20% of Sample

Females: N = 5
Males: N = 7

Regular Class: N = 8
Open Space: N = 4

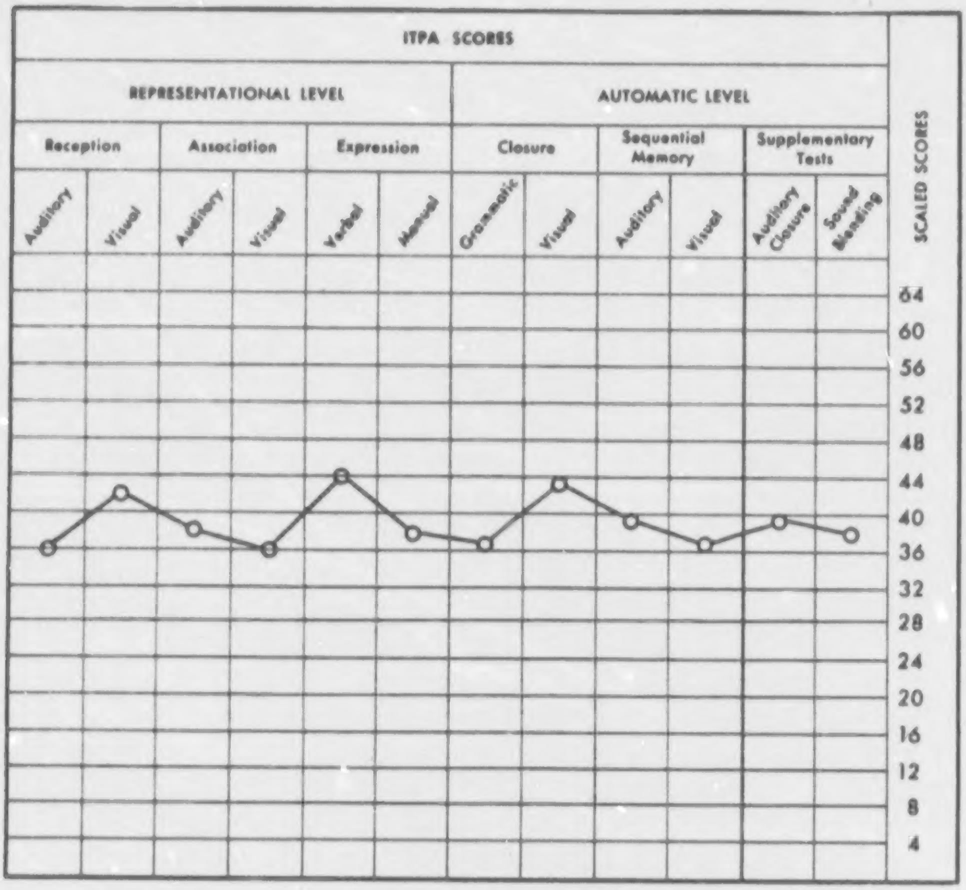

Figure 50. Cluster 13--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: None

Phonetics: None

Age: 75.00 Months
N = 36, 9.60% of Sample

Females: N = 8
Males: N = 28

Regular Class: N = 22
Open Space: N = 14

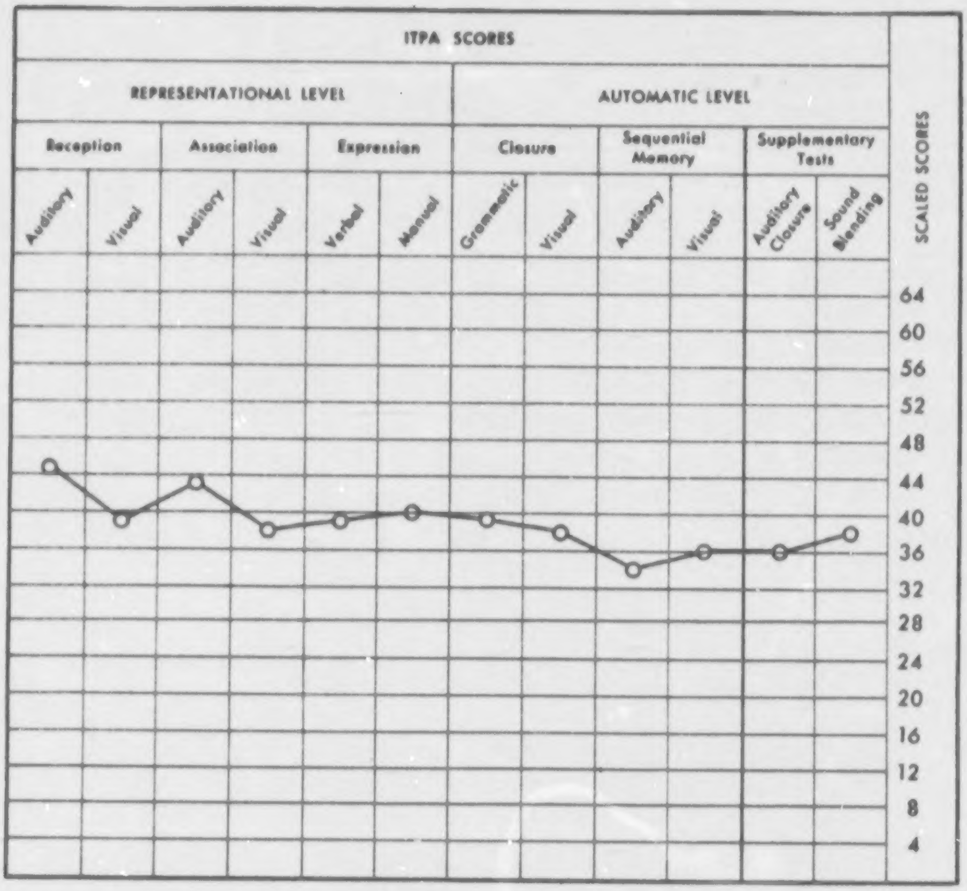

Figure 51. Cluster 14--ITPA Mean Profile (Kindergarten)

WISC: None

PIAT: None

VMI: No

Phonetics: None

APPENDIX G

ITPA MEAN PROFILES BY CLUSTER DESIGNATION FOR THE FIRST GRADE SAMPLE

Age: 85.27 Months
N = 15, 3.90% of Sample

Females: N = 7
Males: N = 8

Regular Class: N = 13
Open Space: N = 2

Significant Below Average Performance (LSDMOD, $p < .05$):

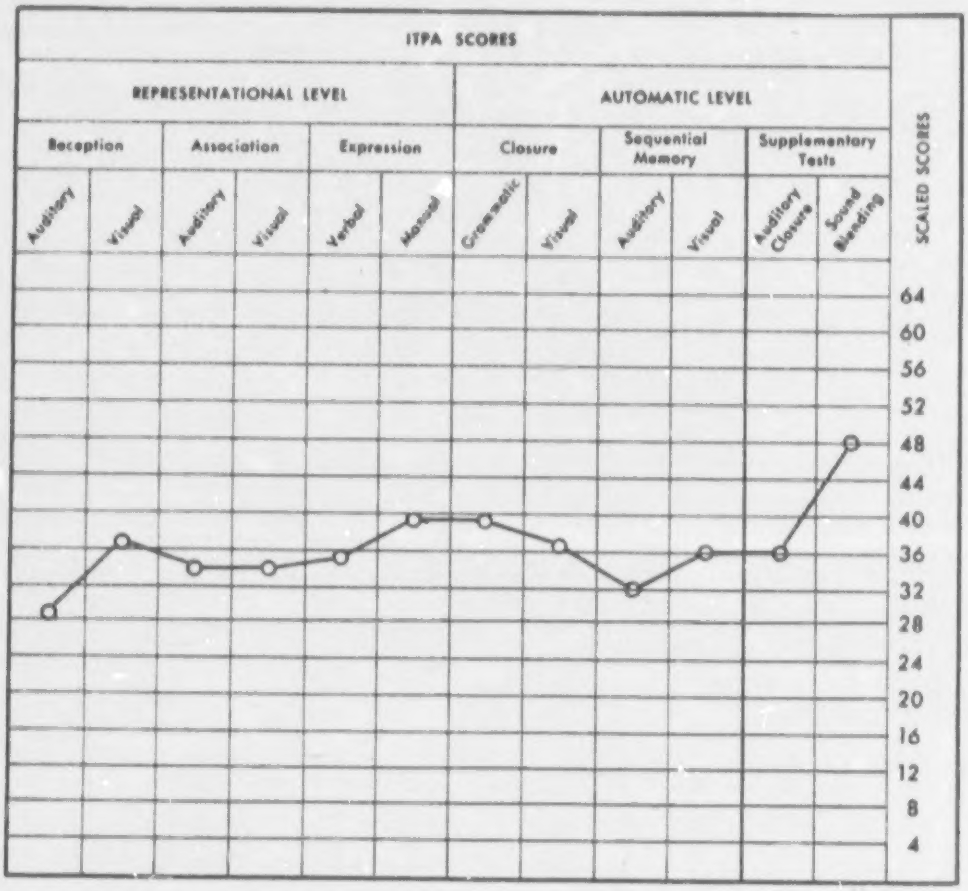

Figure 52. Cluster 2--ITPA Mean Profile (First Grade)

WISC: (M-%tile, 95% Conf. Int.)
Vocab. (37th, 24th to 50th)
Verbal IQ (96-IQ, 90-IQ to 101-IQ)

PIAT: None

Phonetics: None

VMI: No

Age: 87.11 Months
N = 9, 2.30% of Sample

Females: N = 2
Males: N = 7

Regular Class: N = 7
Open Space: N = 2

Significant Above** and Below* Average Performance (LSDMOD, $p < .05$):

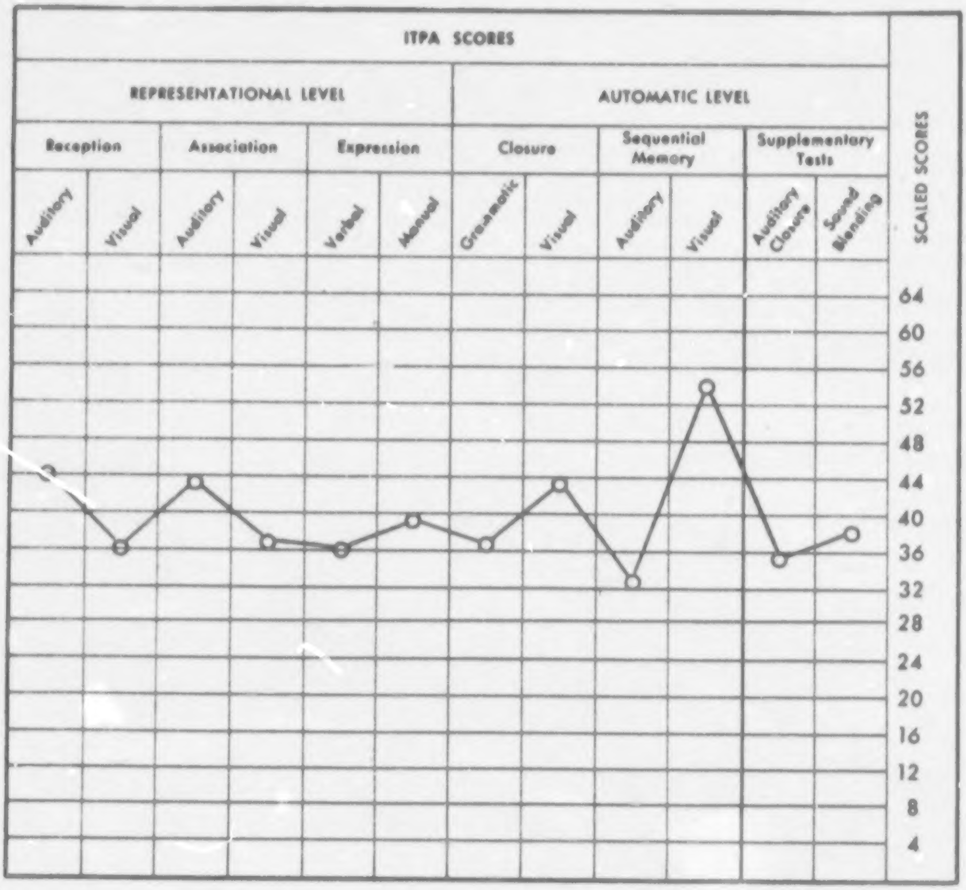

Figure 53. Cluster 7--ITPA Mean Profile (First Grade)

WISC: (M-%tile, 95% Conf. Int.)
Sim. (84th, 50th to 98th)**

PIAT: None

VMI: No

Phonetics*: L & S Vowels
Cons. Blends
Total

Age: 89.26 Months
N = 19, 5.00% of Sample

Females: N = 7
Males: N = 12

Regular Class: N = 16
Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

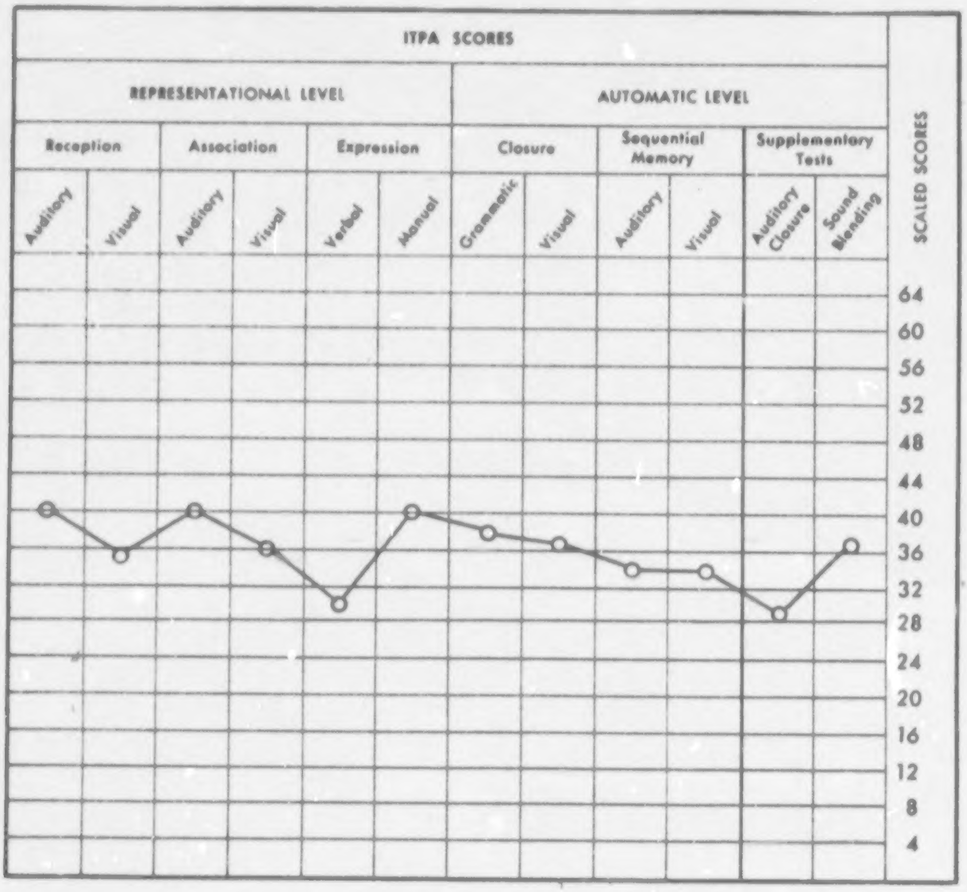

Figure 54. Cluster 8--ITPA Mean Profile (First Grade)

WISC: None

PIAT: None

VMI: No

Phonetics: Cons. Blends
Total

Age: 87.80 Months
N = 20, 5.20% of Sample

Females: N = 8
Males: N = 12

Regular Class: N = 17
Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

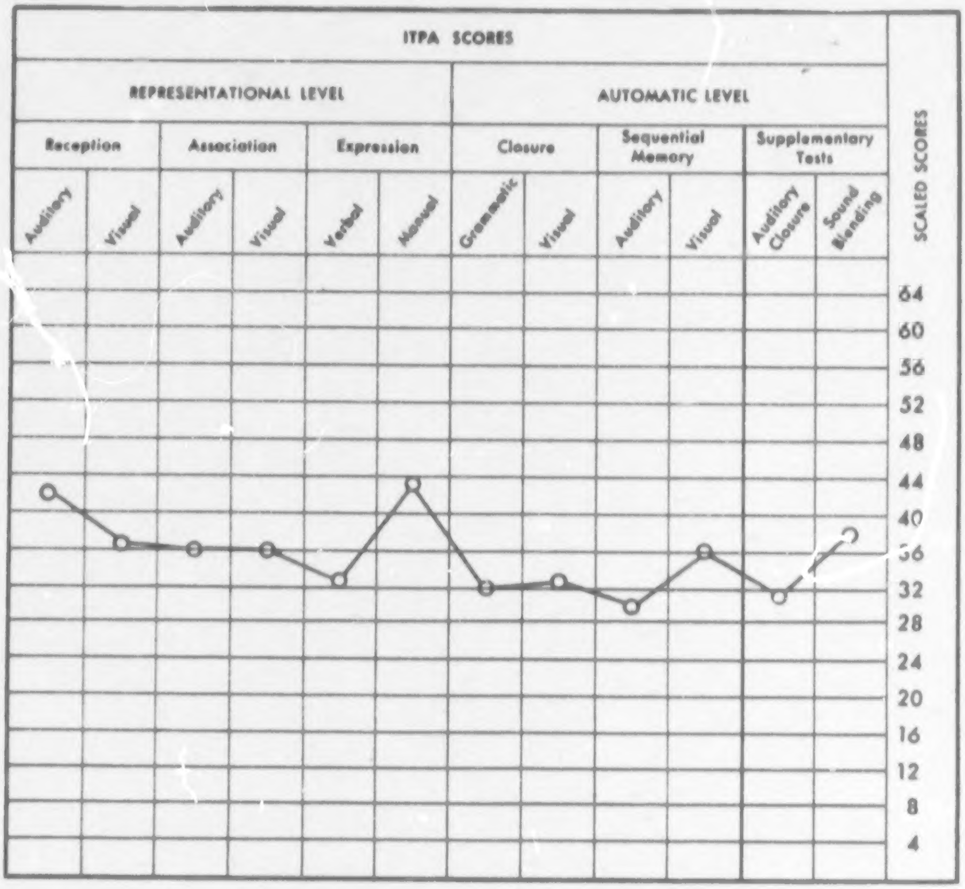

Figure 55. Cluster 9--ITPA Mean Profile (First Grade)

WISC: None

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Read. Com.	(43rd, 33rd to 53rd)
Spelling	(38th, 28th to 49th)
Total	(36th, 29th to 47th)

Phonetics: L & S Vowels
Total

Age:	88.33 Months	Females:	N = 5	Regular Class:	N = 9
N = 12, 3.10% of Sample		Males:	N = 7	Open Space:	N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

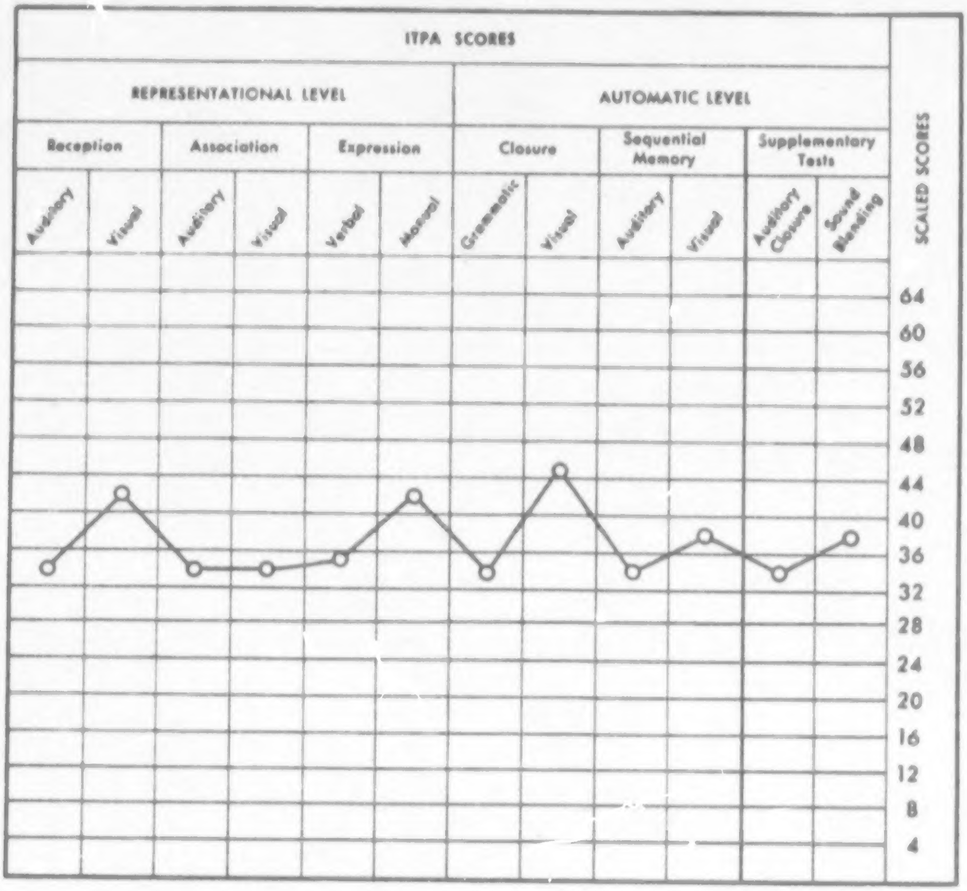

Figure 56. Cluster 12--ITPA Mean Profile (First Grade)

WISC:	(M-%tile, 95% Conf. Int.)
Dig. Span	(24th, 16th to 37th)
Verbal IQ	(95-IQ, 90-IQ to 101-IQ)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(38th, 23rd to 52nd)
Read. Rec.	(27th, 16th to 39th)
Read. Com.	(35th, 21st to 52nd)
Spelling	(31st, 13th to 56th)
Gen. Inf.	(34th, 22nd to 47th)
Total	(29th, 17th to 44th)

Phonetics: L & S Vowels
Final Cons.
Total

Age: 85.91 Months　　Females: N = 4　　Regular Class: N = 8
N = 11, 2.80% of Sample　　Males: N = 7　　Open Space: N = 3

Significant Below Average Performance (LSDMOD, $p < .05$):

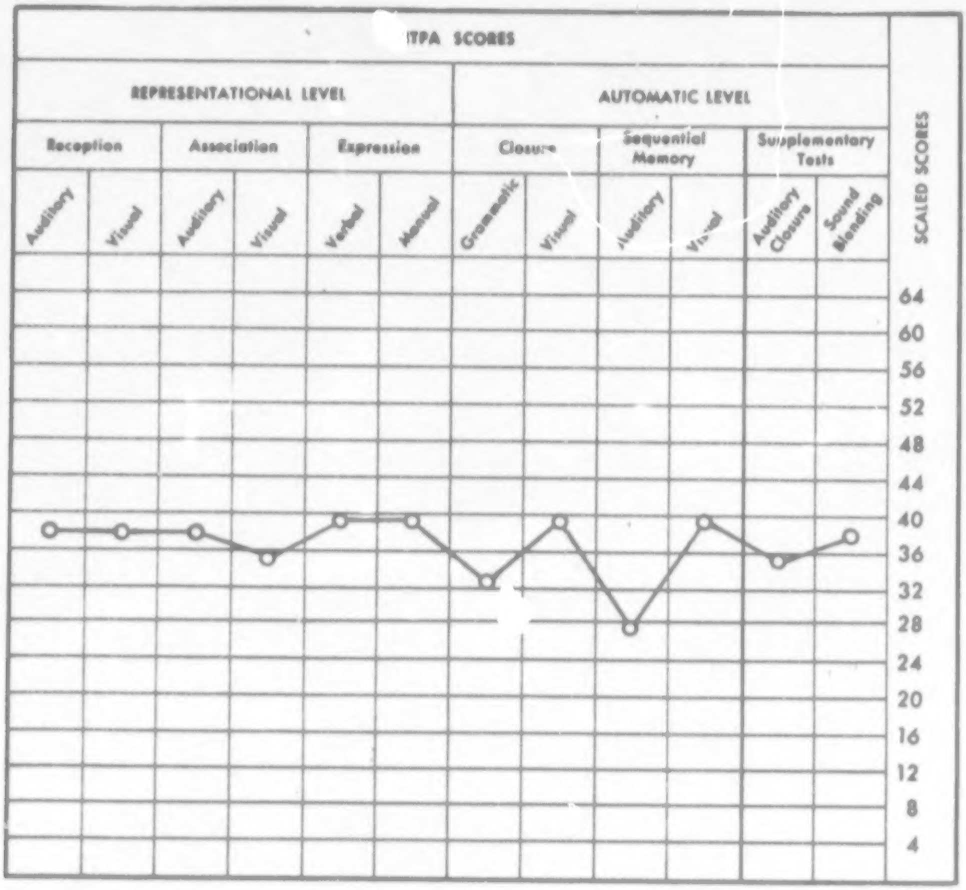

Figure 57. Cluster 13--ITPA Mean Profile (First Grade)

WISC:　　(M-%tile, 95% Conf. Int.)
Dig. Span (24th, 16th to 37th)

PIAT: None

Phonetics: None

VMI: No

Age: 88.43 Months
N = 23, 5.90% of Sample

Females: N = 9
Males: N = 14

Regular Class: N = 16
Open Space: N = 7

Significant below Average Performance (LSDMOD, $p < .05$):

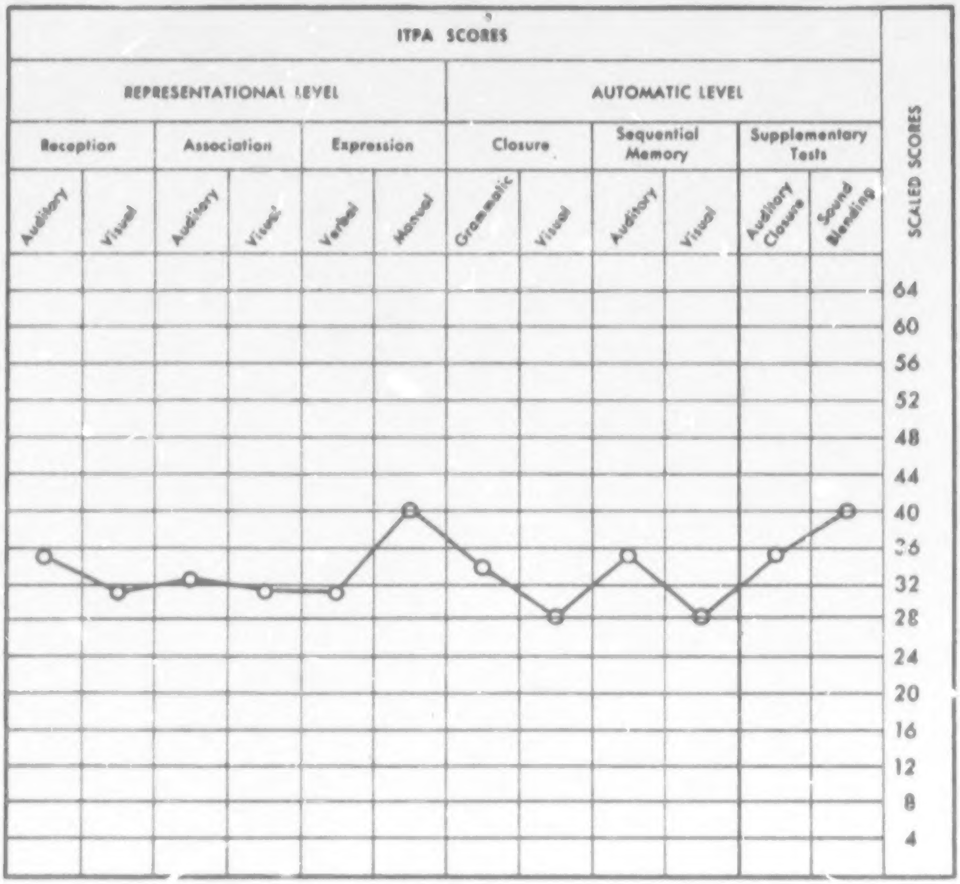

Figure 58. Cluster 20--ITPA Mean Profile (First Grade)

WISC: (M-%tile, 95% Conf. Int.)
Verbal IQ (96-IQ, 91-IQ to 101-IQ)

VMI: No

PIAT: (M-%tile, 95% Conf. Int.)
Math (38th, 31st to 49th)
Gen. Inf. (39th, 27th to 52nd)
Total (39th, 29th to 49th)

Phonetics: None

Age:	88.54 Months	Females:	N = 14	Regular Class:	N = 23
N = 35, 9.00% of Sample		Males:	N = 21	Open Space:	N = 12

Significant Below Average Performance (LSDMOD, $p < .05$):

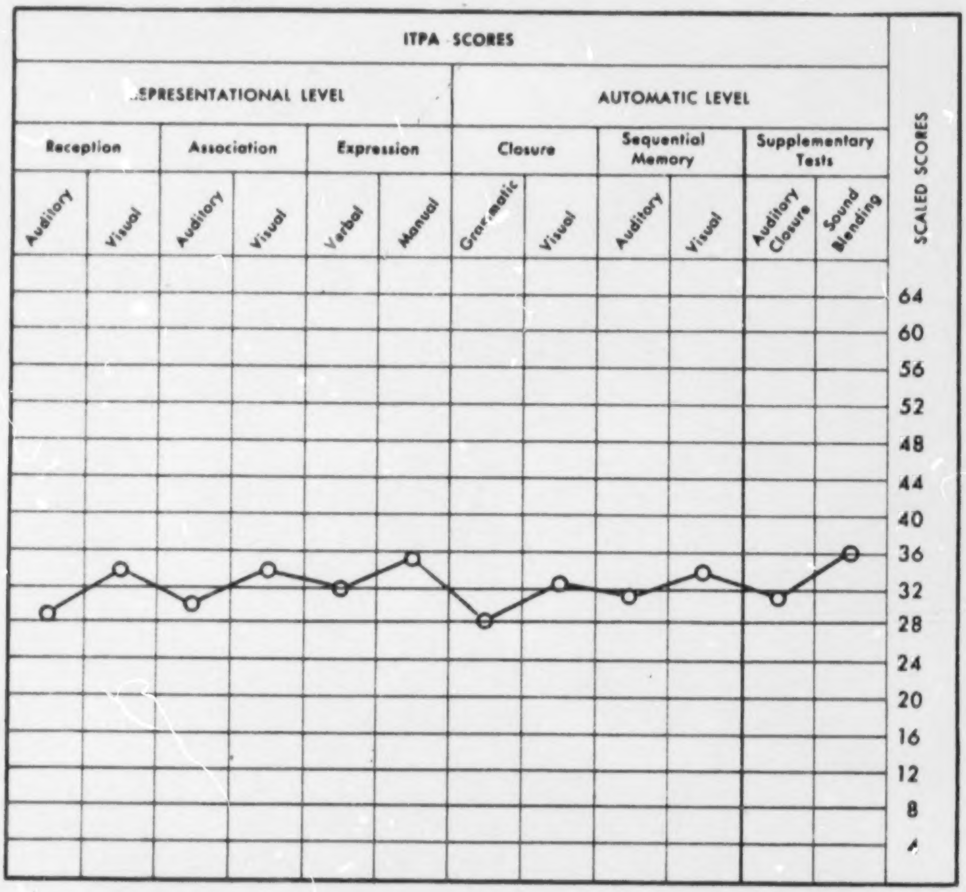

Figure 59. Cluster 22--ITPA Mean Profile (First Grade)

WISC:	(M-%tile, 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Comp.	(24th, 24th to 37th)	Math	(27th, 19th to 35th)
Sim.	(24th, 16th to 37th)	Read. Rec.	(36th, 27th to 44th)
Vocab.	(16th, 16th to 24th)	Spelling	(34th, 25th to 44th)
Dig. Span	(24th, 16th to 37th)	Gen. Inf.	(31st, 23rd to 39th)
Verbal IQ	(89-IQ, 85-IQ to 92-IQ)	Total	(27th, 19th to 34th)

VMI: No

Phonetics: L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 93.50 Months
N = 2, .52% of Sample

Females: N = 0
Males: N = 2

Regular Class: N = 2
Open Space: N = 0

Significant Above** and Below* Average Performance:

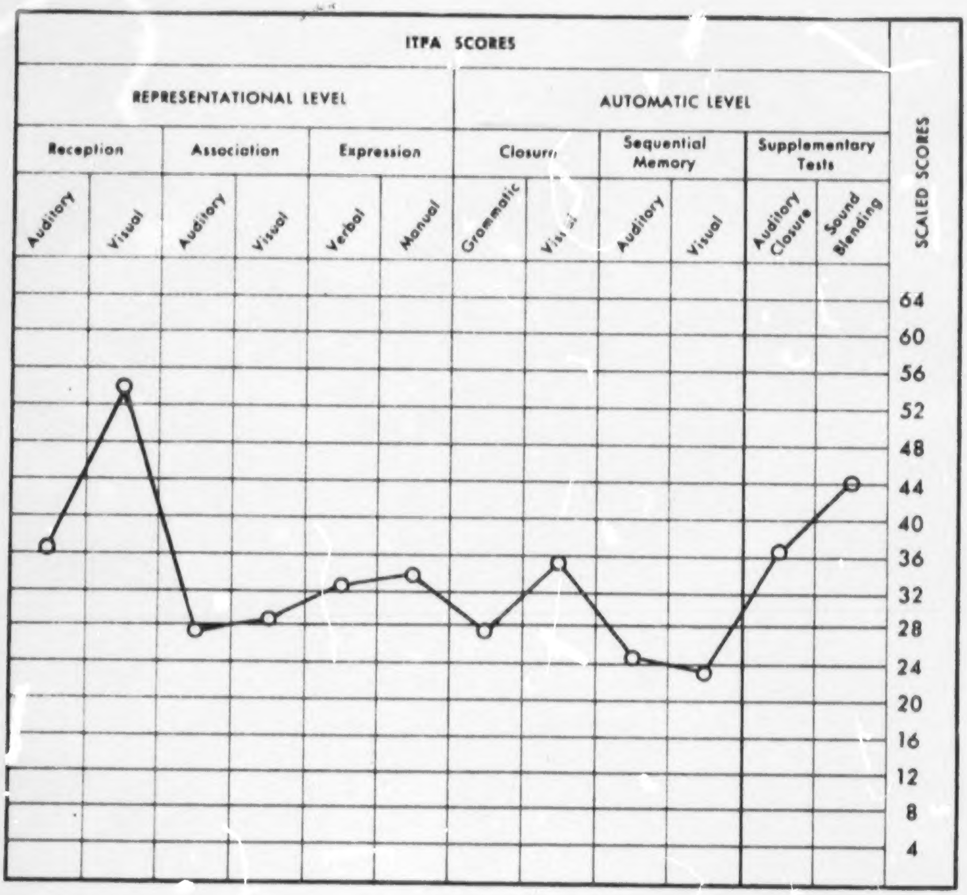

Figure 60. Outlying Cluster 11--ITPA Mean Profile (First Grade)

WISC:	(M-%tile, 95% Conf. Int.)
Comp.	(16th, 5th to 37th)*,**
Sim.	(24th, 5th to 63rd)*,**
Vocab.	(5th, 2nd to 16th)*
Dig. Span	(24th, 24th to 24th)*
Verbal IQ	(80-IQ, 69-IQ to 92-IQ)*

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(16th, 14th to 17th)*
Read. Rec.	(23rd, 23rd to 26th)*
Read. Com.	(27th, 27th to 27th)*
Spelling	(21st, 20th to 23rd)*
Gen. Inf.	(41st, 16th to 72nd)*,**
Total	(18th, 11th to 27th)*

VMI: Yes

Phonetics: None

Age: 83.00 Months
N = 1, .26% of Sample

Females: N = 1
Males: N = 0

Regular Class: N = 1
Open Space: N = 0

Significant Above** and Below* Average Performance:

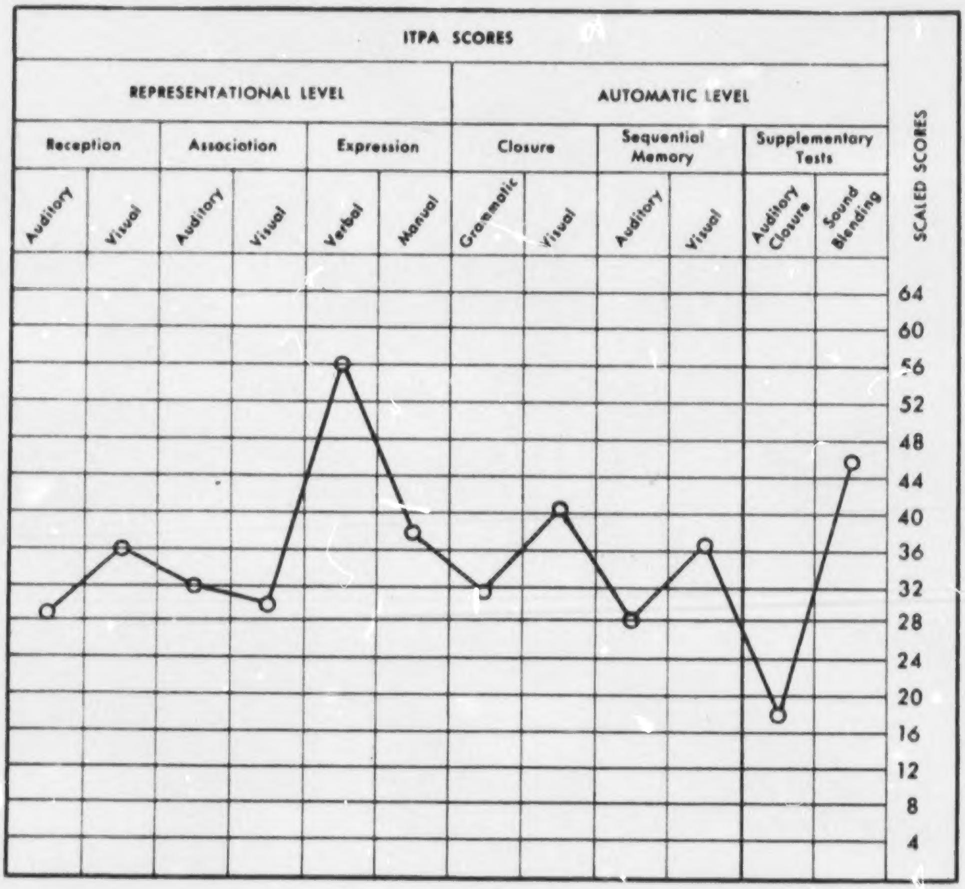

Figure 61. Outlying Cluster 15--ITPA Mean Profile (First Grade)

WISC: (M-%tile)
Sim. (16th)*
Vocab. (16th)*
Verbal IQ (87)

PIAT: (M-%tile)
Math (10th)*
Read. Rec. (69th)**
Read. Com. (66th)**
Spelling (63rd)**
Gen. Inf. (17th)*

Phonetics: L & S Vowels**
Total*

VMI: No

Age: 87.00 Months
N = 1, .26% of Sample

Females: N = 0
Males: N = 1

Regular Class: N = 0
Open Space: N = 1

Significant Above** and Below* Average Performance:

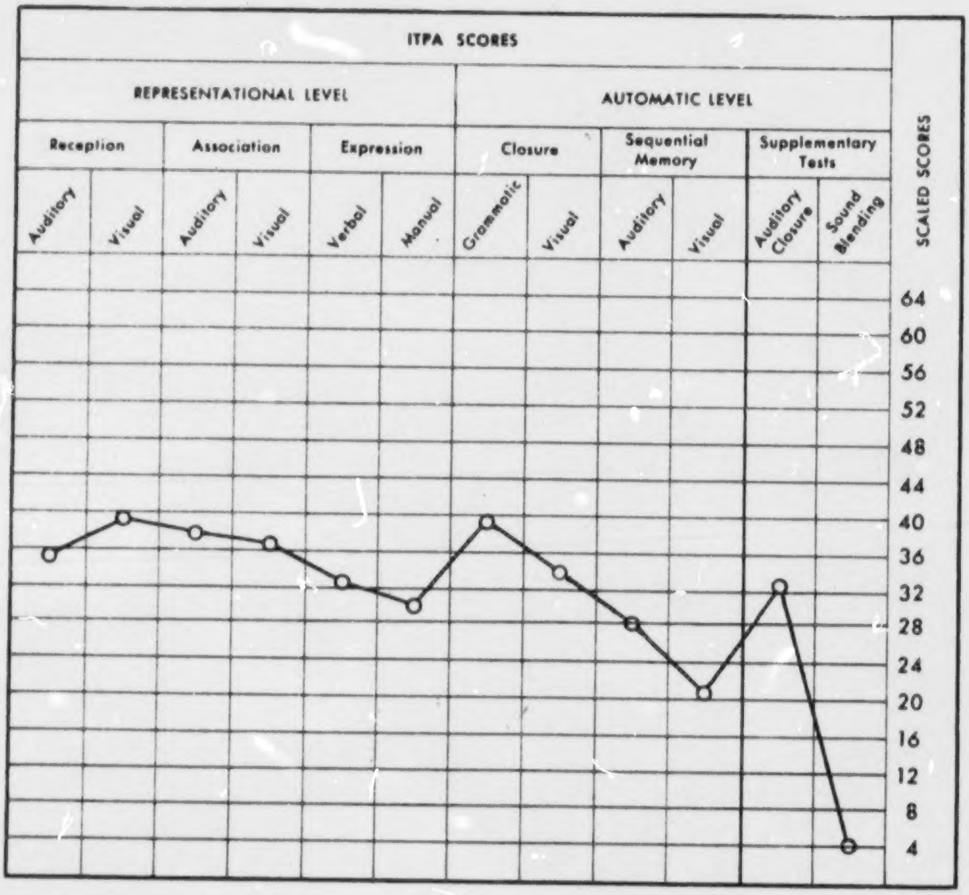

Figure 62. Outlying Cluster 16--ITPA Mean Profile (First Grade)

WISC:	(M-%tile)	PIAT:	(M-%tile)
Sim.	(84th)**	Math	(23rd)*
Vocab.	(75th)**	Read. Rec.	(20th)*
Dig. Span	(9th)*	Spelling	(15th)*
Verbal IQ	(104)	Total	(10th)*

Phonetics: None

VMI: Yes

Age: 88.00 Months
N = 1, .26% of Sample

Females: N = 1
Males: N = 0

Regular Class: N = 1
Open Space: N = 0

Significant Above** and Below* Average Performance:

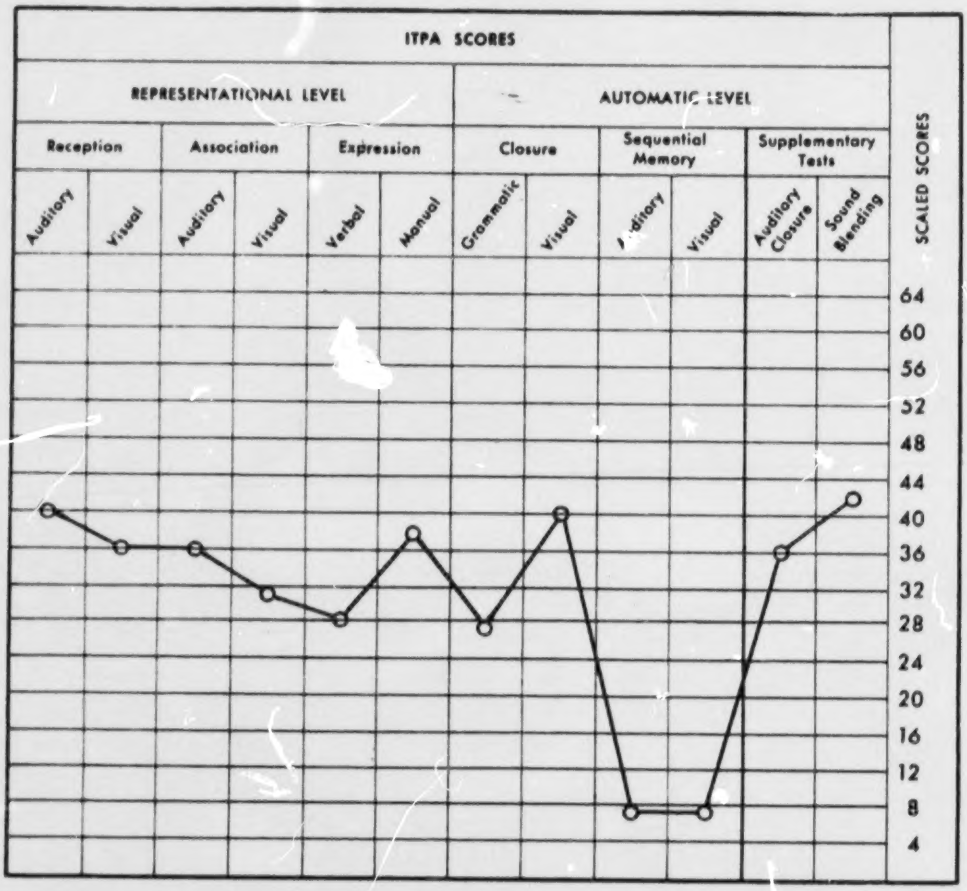

Figure 63. Outlying Cluster 19--ITPA Mean Profile (First Grade)

WISC: (M-%tile)
Sim. (24th)*
Dig. Span (24th)*
Verbal IQ (95)

PIAT: (M-%tile)
Math (27th)*
Read. Rec. (27th)*
Read. Com. (37th)*
Gen. Inf. (69th)**
Total (39th)*

Phonetics: None

VMI: Yes

Age:	91.00 Months	Females:	N = 0	Regular Class:	N = 0
N = 1, .26% of Sample		Males:	N = 1	Open Space:	N = 1

Significant Below Average Performance:

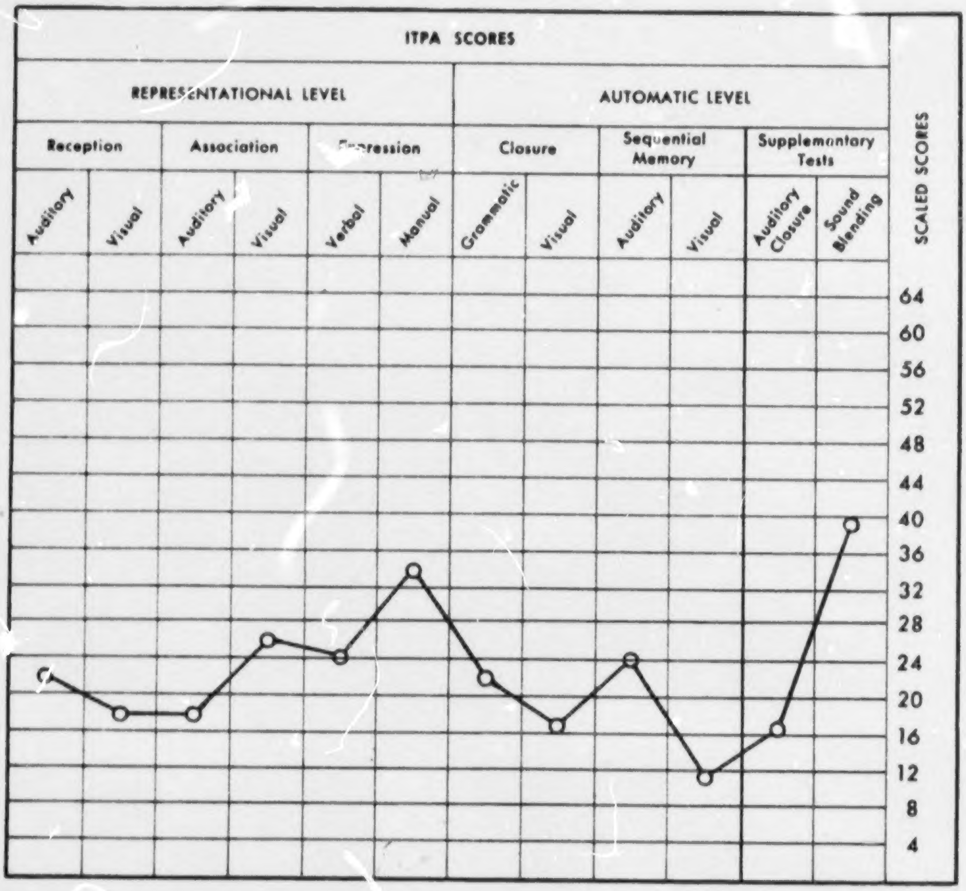

Figure 64. Outlying Cluster 21--ITPA Mean Profile (First Grade)

WISC:	(M-%tile)	PIAT:	(M-%tile)	Phonetics:	
Comp.	(1st)	Math	(1st)		Init. Cons.
Sim.	(24th)	Read. Rec.	(9th)		Final Cons.
Vocab.	(1st)	Read. Com.	(1st)		L & S Vowels
Dig. Span	(2nd)	Spelling	(8th)		Cons. Blends
Verbal IQ	(62)	Gen. Inf.	(1st)		Total
		Total	(4th)		

VMI: Yes

Age: 90.50 Months
N = 2, .52% of Sample

Females: N = 1
Males: N = 1

Regular Class: N = 2
Open Space: N = 0

Significant Above** and Below* Average Performance:

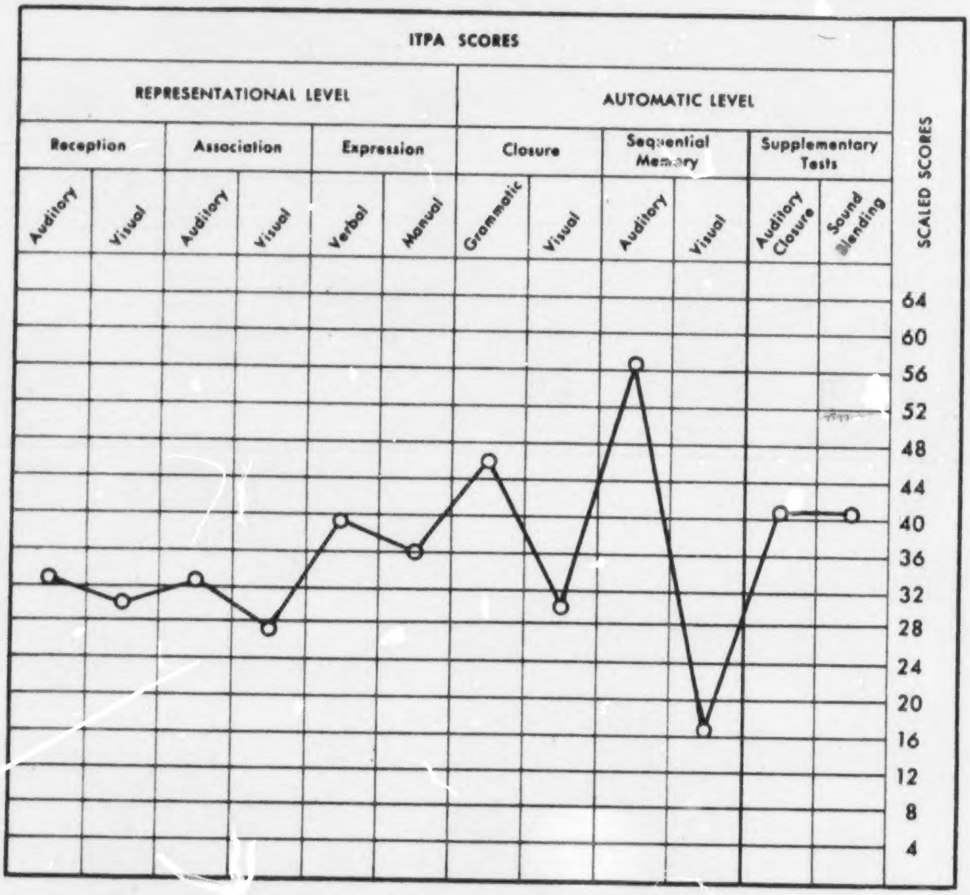

Figure 65. Outlying Cluster 23--ITPA Mean Profile (First Grade)

WISC:	(M-%tile, 95% Conf. Int.)
Comp.	(75th, 50th to 91st)**
Sim.	(98th, 95th to 98th)**
Vocab.	(75th, 63rd to 84th)**
Dig. Span	(75th, 75th to 75th)**
Verbal IQ	(125-IQ, 120-IQ to 130-IQ)**

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(37th, 31st to 41st)*
Read. Rec.	(55th, 27th to 83rd)*,**
Gen. Inf.	(45th, 25th to 63rd)*,**
Total	(43rd, 25th to 57th)*

Phonetics: None

VMI: Yes

Age: 87.00 Months Females: N = 4 Regular Class: N = 5
N = 8, 2.10% of Sample Males: N = 4 Open Space: N = 3

Significant Above Average Performance (LSDMOD, $p < .05$):

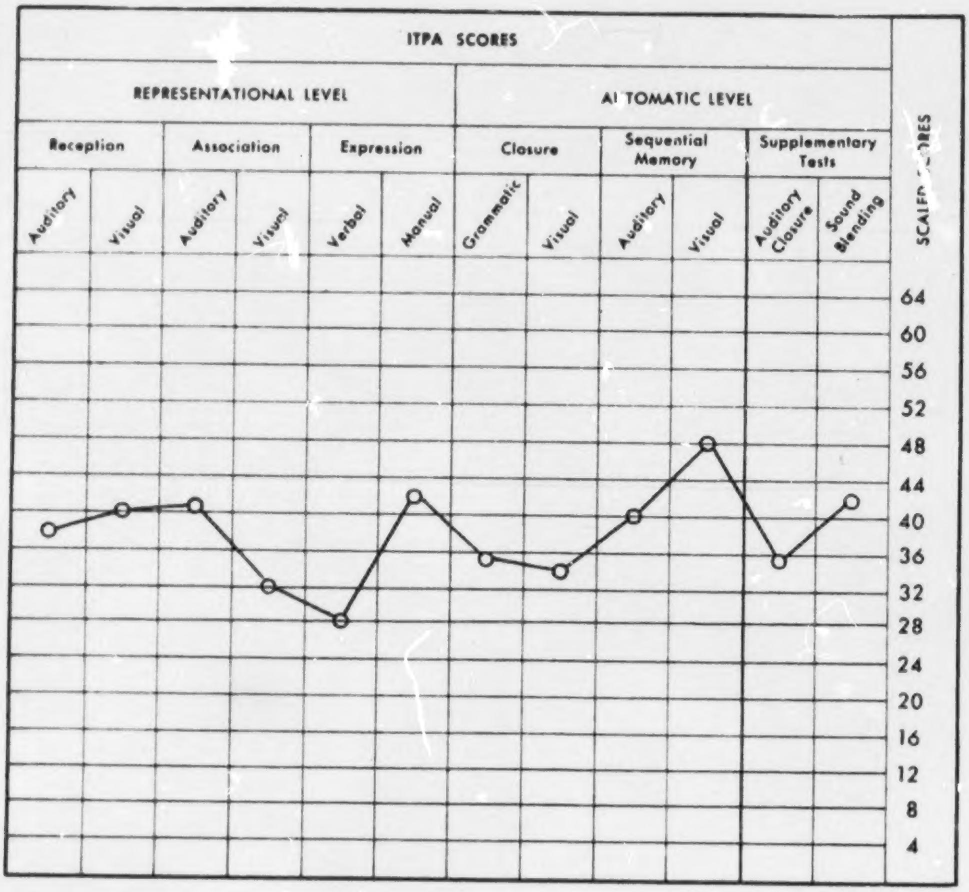

Figure 66. Cluster 5--ITPA Mean Profile (First Grade)

WISC: (M-%tile, 95% Conf. Int.) PIAT: None
Dig. Span (75th, 24th to 95th)

Phonetics: None

VMI: No

Age: 85.47 Months
N = 59, 15.20% of Sample

Females: N = 20
Males: N = 39

Regular Class: N = 46
Open Space: N = 13

Significant Above Average Performance (LSDMOD, $p < .05$):

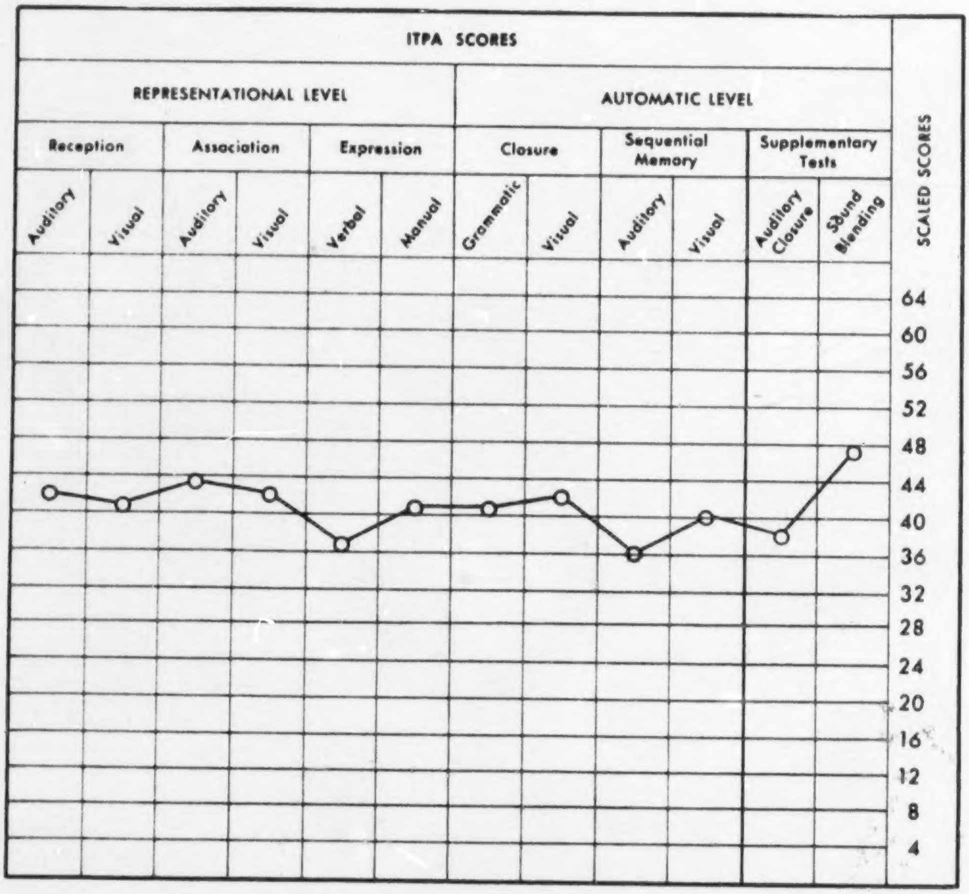

Figure 67. Cluster 6--ITPA Mean Profile (First Grade)

WISC:	(M-%tile, 95% Conf. Int.)	PIAT:	(M-%tile, 95% Conf. Int.)
Comp.	(75th, 63rd to 84th)	Read. Rec.	(69th, 61st to 75th)
Sim.	(84th, 75th to 91st)	Read. Com.	(71st, 66th to 77th)
Vocab.	(63rd, 50th to 75th)	Spelling	(63rd, 59th to 69th)
Dig. Span	(63rd, 50th to 63rd)	Gen. Inf.	(71st, 66th to 77th)
Verbal IQ	(110-IQ, 106-IQ to 113-IQ)	Total	(66th, 61st to 70th)

VMI: No

Phonetics: None

Age: 87.10 Months Females: N = 7 Regular Class: N = 17
N = 20, 5.20% of Sample Males: N = 13 Open Space: N = 3

Significant Above Average Performance (LSDMOD, $p < .05$):

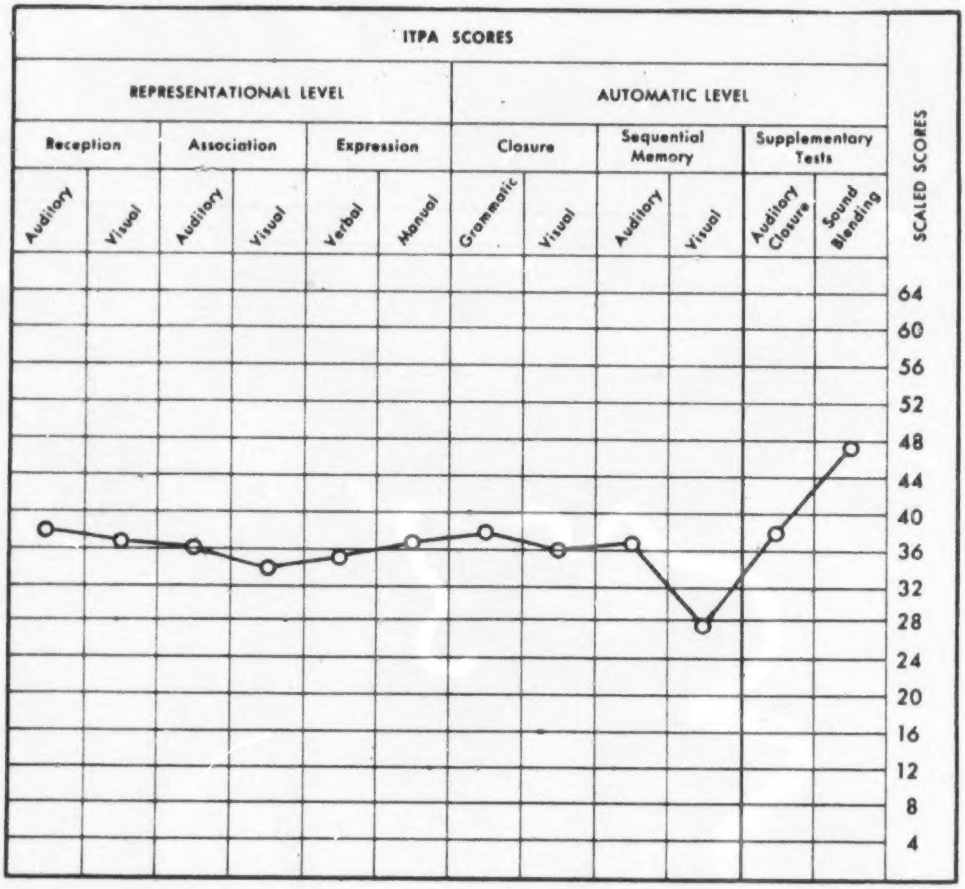

Figure 68. Cluster 18--ITPA Mean Profile (First Grade)

WISC: (M-%tile, 95% Conf. Int.)
Sim (75th, 63rd to 91st)

PIAT: None

Phonetics: None

VMI: No

Age: 84.86 Months		Females:	*N* = 25	Regular Class:	*N* = 53
N = 64, 16.50% of Sample		Males:	*N* = 39	Open Space:	*N* = 11

Significant *Above* Average Performance (LSDMOD, *p* <.05):

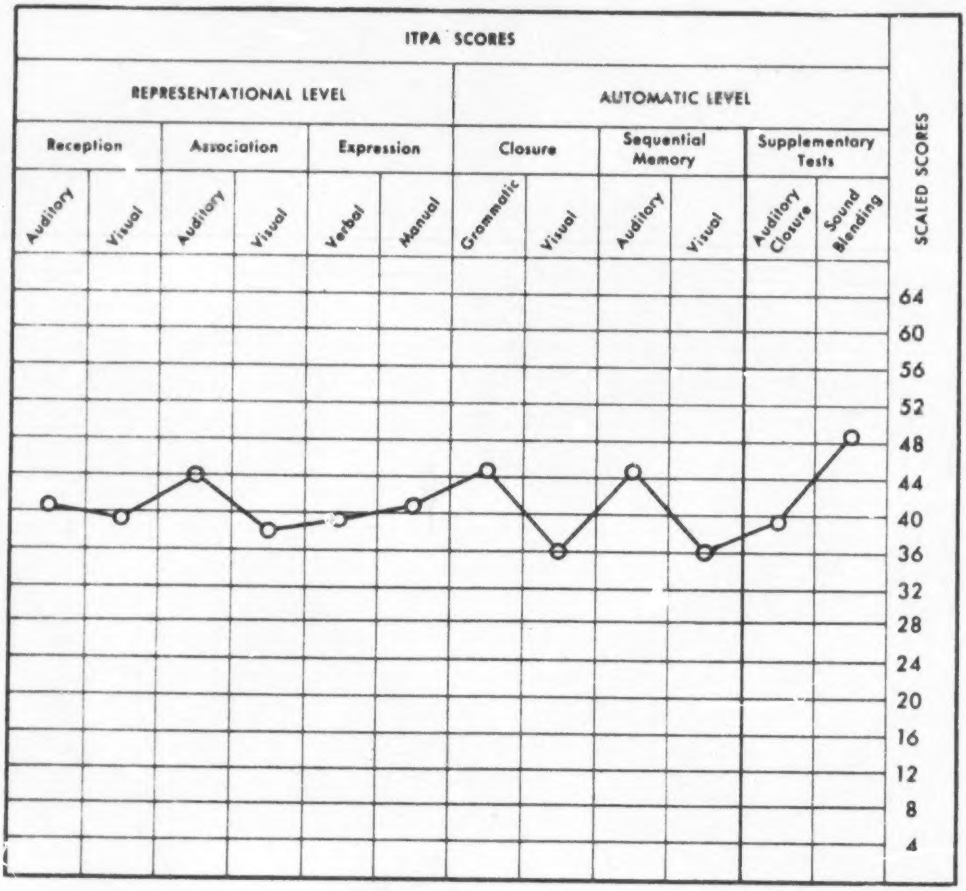

Figure 69. Cluster 24--ITPA Mean Profile (First Grade)

WISC:	(M-%tile, 95% Conf. Int.)
Comp.	(75th, 63rd to 84th)
Sim	(91st, 84th to 95th)
Vocab.	(75th, 63rd to 84th)
Dig. Span	(75th, 75th to 84th)
Verbal IQ	(115-IQ, 111-IQ to 118-IQ)

VMI: No

PIAT:	(M-%tile, 95% Conf. Int.)
Math	(74th, 70th to 77th)
Read. Rec.	(83rd, 79th to 87th)
Read. Com.	(81st, 77th to 84th)
Spelling	(77th, 71st to 81st)
Gen. Inf.	(75th, 71st to 81st)
Total	(77th, 73rd to 81st)

Phonetics: L & S Vowels
Final Cons.
Cons. Blends
Total

Age: 88.82 Months   Females: N = 14   Regular Class: N = 28
N = 39, 10.00% of Sample   Males: N = 25   Open Space: N = 11

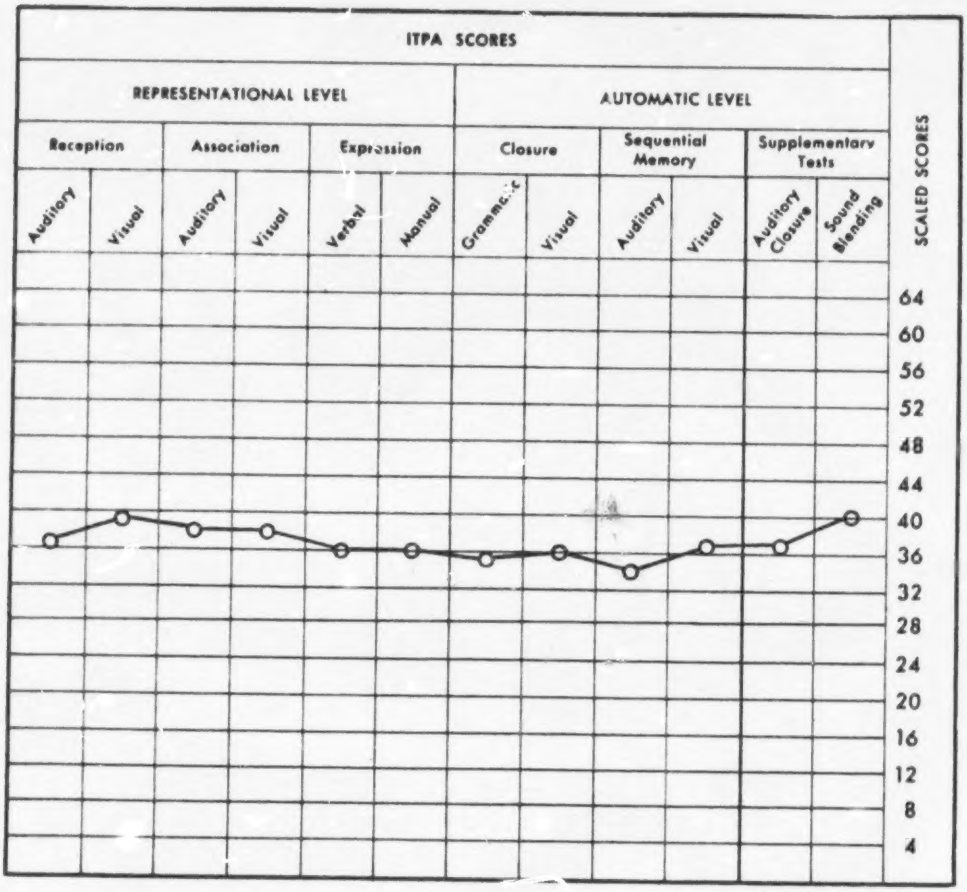

Figure 70. Cluster 1 Plus Cluster 4 Plus Cluster 14--ITPA Mean Profile (First Grade)

Age: 87.33 Months
N = 9, 2.30% of Sample

Females: N = 3
Males: N = 6

Regular Class: N = 7
Open Space: N = 2

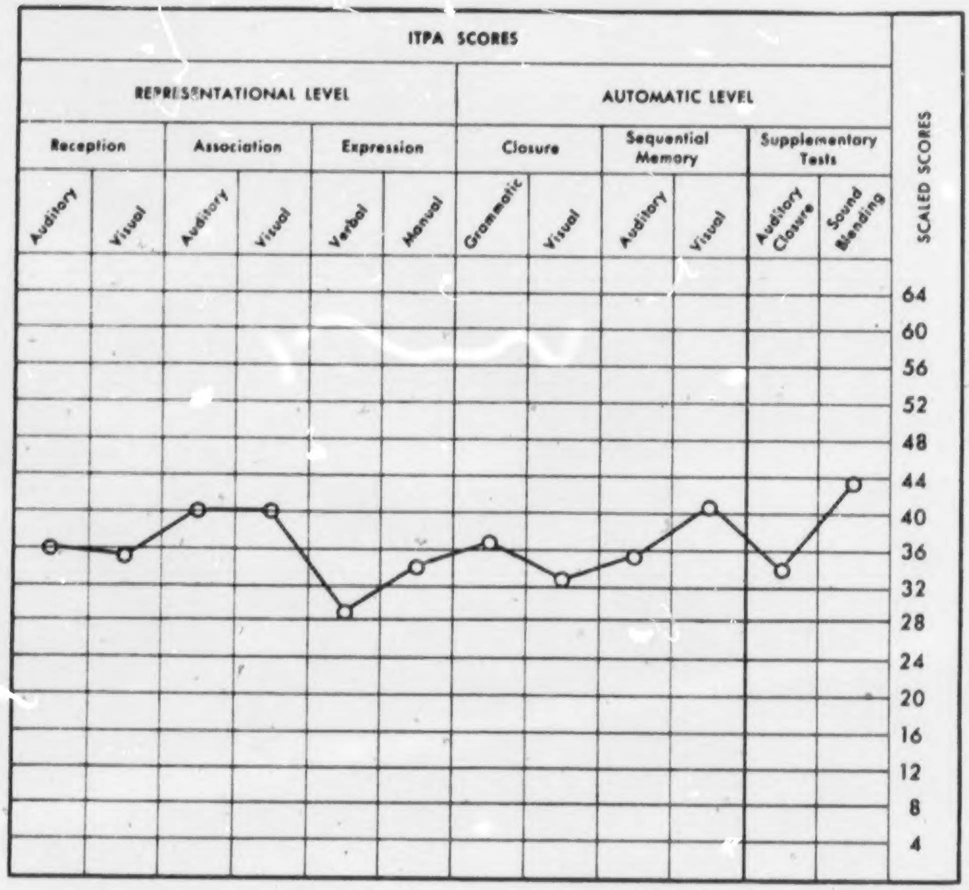

Figure 71. Cluster 3--ITPA Mean Profile (First Grade)

Age: 87.35 Months
N = 14, 3.60% of Sample

Females: N = 5
Males: N = 9

Regular Class: N = 9
Open Space: N = 5

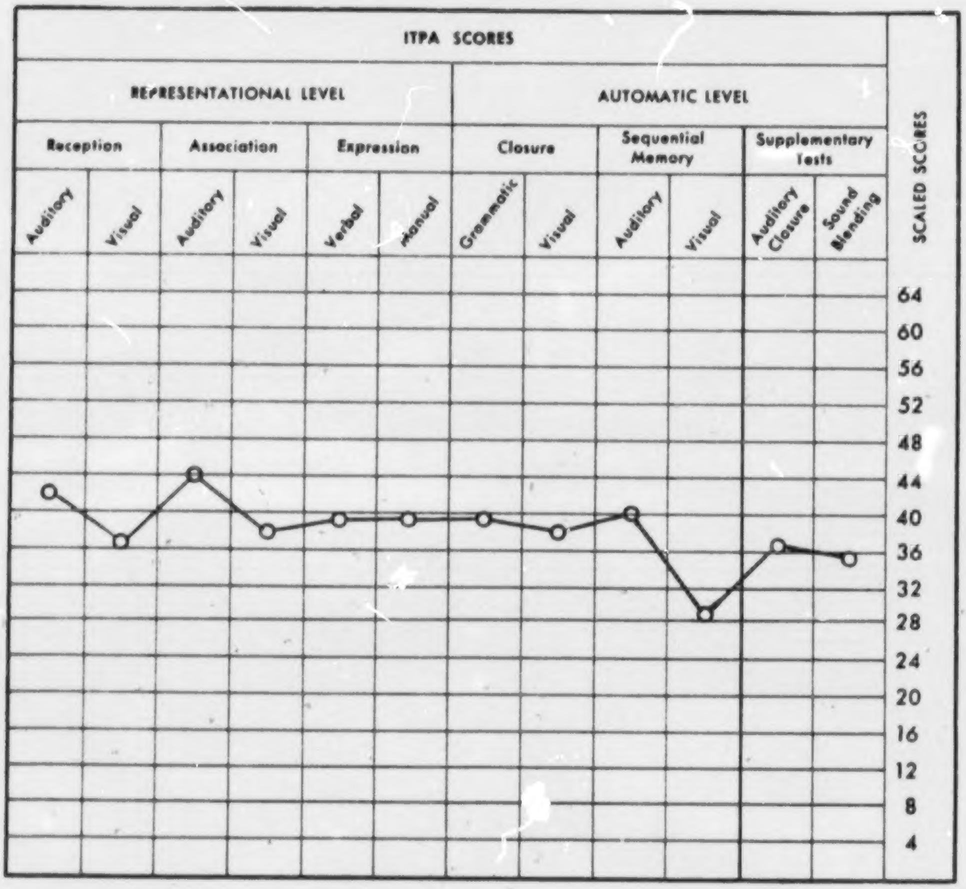

Figure 72. Cluster 10--ITPA Mean Profile (First Grade)

Age: 86.22 Months
N = 23, 5.90% of Sample

Females: N = 11
Males: N = 12

Regular Class: N = 18
Open Space: N = 5

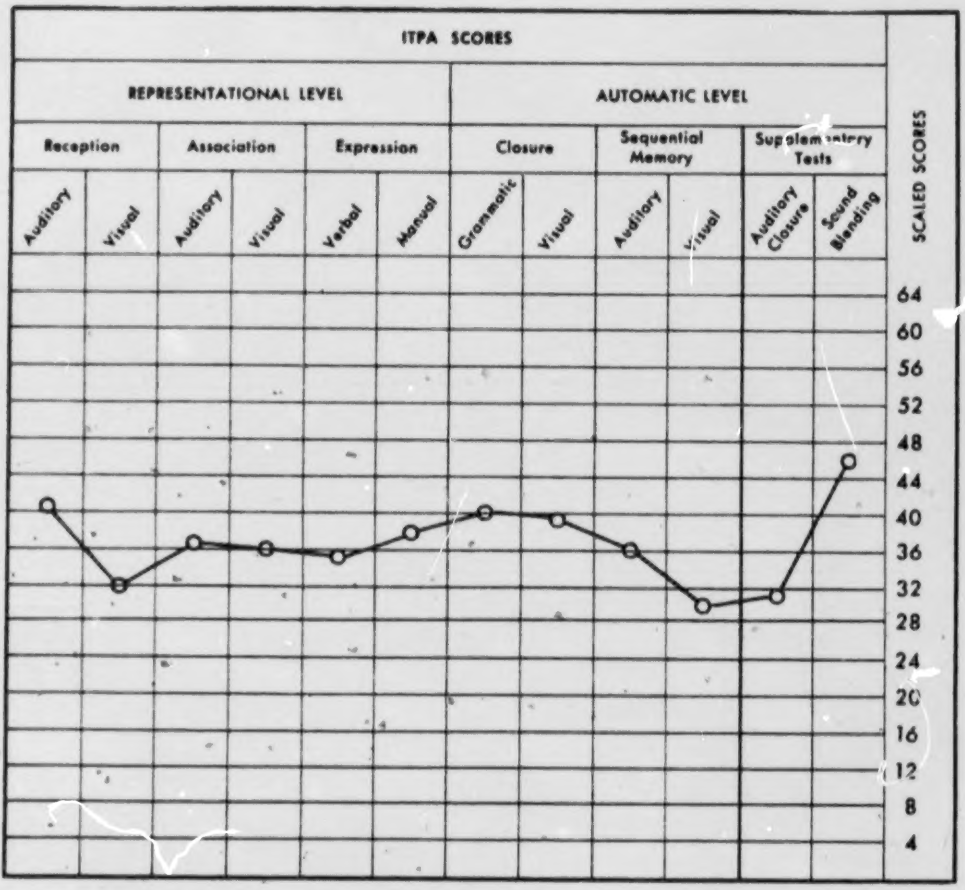

Figure 73. Cluster 17--ITPA Mean Profile (First Grade)

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